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SEPTEMBER, 1826.

FOR THE FRANKLIN JOURNAL.

Specification of certain improvements in the Locomotive Engine, and in the mode of transferring loaded carriages from one level to another, in their passage upon rail-ways. By S. H. Long, *Major of Topographical Engineers. With four copper-plate engravings.*

[FILED IN THE UNITED STATES PATENT OFFICE.]

The Locomotive Engine in present use, is applied only to the propelling of loaded carriages upon horizontal rail-ways, or such as have a slight inclination only. In situations where a transition is to be effected from one level to another, Inclined Planes are interposed between the different horizontal sections of the rail-road, and the transfer is usually effected by means of these and stationary Steam Engines, or other stationary machinery; the Locomotive Engine as hitherto employed, being inadequate to this purpose. The improvements under consideration, provide for the transfer of loaded carriages, both ascending and descending, by means of the Locomotive Engine, independently of any aid from extraneous powers. The manner of accomplishing these objects will be explained under three distinct heads, to be denominated the first, second, and third, methods.

FIRST METHOD.

The machinery contemplated in connexion with this method, consists of the following variations and additions, in the construction of the Locomotive Engine and its rail-way, viz.

1st. The axles of the carriage-wheels of the engine, must be constructed in a manner to admit of their revolving, both in bearings or steps attached to the carriage frame, and in the hubs or naves of their respective wheels.

2nd. Cranks to receive the action of the steam engine, must be firmly attached to the ends of the axles.

3d. Ratchet wheels must be firmly attached to the outer ends of the hubs of the carriage-wheels, to be acted upon by ratchets, applied to the cranks.

4th. A pinion is to be added to each axle, and is to act upon a rack, or toothed rail, located mid-way of the rail-track, of each inclined plane.

These several modifications in the construction of the engine, and its rail-way, will be more fully explained in the following

REFERENCES TO THE DRAWINGS.

Fig. 1. A view of the ratchet wheel, and ratchet, with their adjustments. AA, The ratchet wheel attached to the outer end of the hub, as represented at *aa*.

B, The ratchet, traversing upon the wrist of the crank, and connected to the spring *cc*, by means of the part *b*, and the connecting rod *bc*.

C, The crank, the wrist of which passes through it, and serves also as a pivot for the ratchet B. The spring *cc*, is attached to the crank, by means of screws near to its inner, or butt-end.

D, The trigger, serving as a prop to sustain the ratchet, when out of gear: *n*, a pintle, passing through the ratchet B, the outer end of which plies in the slit of the trigger D, while the inner end serves as a knob or spanner, whereby to lift the ratchet out of gear.

Fig. 2. A view of the washer, situated between the crank and the hub, or ratchet wheel, together with the trigger attached to it.

D, The washer and trigger connected. *d*, A spring upon the outside of the trigger, serving to confine the pintle (*n*, fig. 1) when at the end of the slit.

N. B. The trigger, instead of being connected with the washer, may be attached to any convenient part of the crank, in a manner to admit of the requisite oscillatory movements.

Fig. 3. A view of the carriage of the Locomotive Engine, together with its pinions, and the rack or toothed rail.

A, The carriage wheels.

a, The ratchet wheels, as represented at A, fig. 1.

B, The axles of the carriage, traversing in bearings attached to the carriage frame; as also in the hubs of the carriage wheels, as the occasion may require.

C, The cranks firmly attached to the outer ends of the axles, and separated from the ratchet wheels by washers, as before intimated. *b* and *c*, The same as in fig. 1.

D, The pinions or small cog-wheels, mid-way of the axles, to be employed in the passage of inclined planes.

E, Cog or toothed wheels, for the reception of the endless-chain *e*.

F, A sort of compound axle tree, furnished with bearings for the axles, and constituting a part of the carriage frame or bed.

G, A portion of the toothed rail or rack, located within the rail-track, and adapted to the reception of the pinions D.

N. B. The extent of the rack along the rail-way, should be such as to embrace the whole length of the inclined plane; and in addition thereto, should occupy a space at each end of the plane, equal in extent to that occupied by an entire train of carriages.

In case the inclination of a plane should be too great for the ascent of a Locomotive Engine, with its entire train of carriages at once, it is proposed to arrange the carriages partly in front, and partly in rear of the engine, that one half, instead of the whole load, may be raised at a time. In this case, the steam engine must be furnished with apparatus to reverse the movements of the steam valves, so that the Locomotive Engine, after having ascended with half its load, may return *backwards* for the other half.

The action of the Locomotive Engine may be greatly increased, in the following manner, viz. Let a cog-wheel, of as large a size as the situation will admit, be located vertically between the two chain wheels, so as to receive the action of the endless-chain, both above and below; and let a pinion be attached to its axis, and ply into the toothed rail of the rail track, as before; and the power or action may be increased to any desirable extent.

As a means of preventing the too rapid descent of the Locomotive Engine, and train, in their passage down an inclined plane, the following expedients are suggested, with the belief that they never have been resorted to on any similar occasions, viz.

1st. Let the throttle valve be closed, and the steam engine allowed to labour without a supply of steam. In this case, the movements of the piston will be counteracted by a force equal to one atmosphere on its area, which will probably operate as a check, sufficient for the purpose above mentioned.

Should the retarding power thus produced, prove too great, it may be diminished at pleasure, by admitting a greater, or less, supply of steam, through the throttle valve.

2nd. Let the *escape* tube be furnished with a valve, similar to the throttle valve in common use: also, let a communication be formed between the *supply* and *escape* tubes, by means of a tube, furnished with a similar valve, and we have a modification of the steam engine, by means of which, the retarding power may be increased or diminished at pleasure.

The maximum resistance attainable by this arrangement, is equal to the full power of the engine, added to that of one atmosphere, acting upon the area of the piston.

REMARKS.

The improvements, or discoveries, intended to be embraced and described in the foregoing specification, and claimed as original and new, are,

1st, The compound movements of the carriage wheels and their axles, as applied to the Locomotive Engine.

2nd, The arrangement of the machinery, in such a manner, that the power or action of the steam engine in propelling the train of carriages, may be applied directly to the wheels that sustain the Locomotive Engine, or, to the pinions attached to their axles; thereby adapting the locomotive power both to the passage of horizontal roads, and to the ascent of inclined planes.

3d. The mode of retarding the engine, and its train of carriages, in their passage downward, on inclined planes.

SECOND METHOD.

The agents to be employed in effecting the transition from one level to another, agreeably to the method now under consideration, consist of the following machines, viz.

1st, A Locomotive Engine, differing from those in present use, in the substitution of a cog-wheel and axle, and two pinions, instead of the toothed wheels and endless-chain; in the introduction of an additional pinion upon the axle of the cog-wheel just mentioned; and in the addition of sockets or steps, to serve as receptacles for props, to elevate and sustain the entire weight of the engine.

2nd, A machine to be denominated the Rail-road Crane, to be employed for the purpose of elevating the Locomotive Engine so high, that its wheels may revolve freely without impinging against the rails of the road, and for other purposes.

3d, A Hydraulic-Double-Brake, and other apparatus, for the purpose of retarding a carriage, or train of carriages, in their passage down an inclined plane.

The parts of which these several machines are composed, and the uses for which they are intended, so far as they may have any claim to novelty, either in their construction, or manner of operation, will be considered in the following

EXPLANATIONS OF THE DRAWINGS.

Fig. 4. A view of the carriage of the Locomotive Engine, adapted to the method above mentioned.

A, The carriage-wheels, firmly connected to their axles, which traverse in steps attached to the carriage frame, or bed.

a, Pinions cast with the wheels A, and acting upon the cog-wheel B.

x, The crank-wrists, upon which the steam engine operates.

B, A cog-wheel firmly attached to its axle *b*, and serving to equalize the revolutions of both pairs of wheels; as also the action of the steam-engine upon them, and at the same time giving motion to the pinion C.

D, Parts of the carriage-frame or bed, to be supplied with steps or bearings for the axles above mentioned.

N. B. Cog-wheels, and pinions, may be attached to both sides of the carriage, instead of one side only, as represented in the figure, in case the single set should not be found to answer the purpose so well.

Fig. 5. A view of the Rail-road Crane, and several of its appendages.

E, The cheeks, or side timbers of the crane, connected together by the ties or girders, *e*. The cheeks are to be furnished with props at R, and with friction wheels immediately below the props.

Fig.2.

Fig.1.

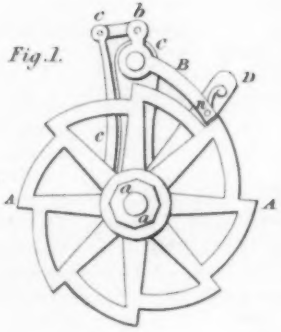


Fig.4.

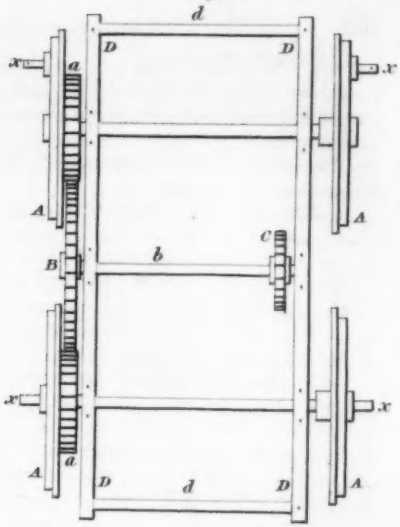
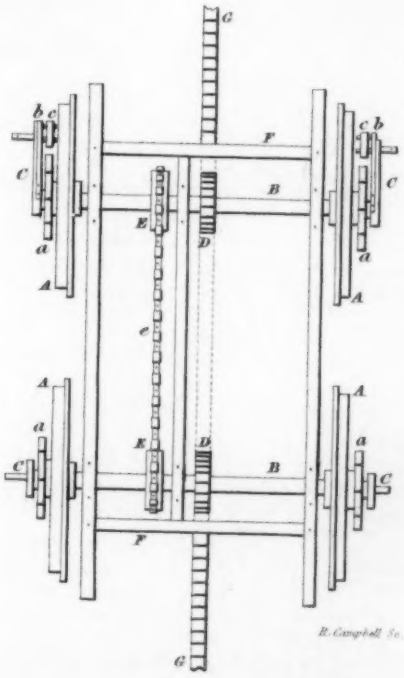


Fig.3.



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F, Windlasses furnished with wipers, or excentric wheels, corresponding to the friction wheels of the cheeks, or frame.

f, Leavers, or segments of wheels, by which the windlasses are made to traverse on their gudgeons.

G, Cills or sleepers, furnished with steps at *g*, for the reception of the gudgeons of the windlasses.

H, A cog-wheel, firmly attached to the shaft *h*, and adapted to the reception of the pinion C, fig. 4, by which it is to be put into action.

h, A shaft or axle, turning in steps attached to the cheeks, E.

I, A toothed wheel or pinion, fixed to the centre of the shaft *n*, and fitted for the reception of the endless-chain, by which the loaded carriages are to be drawn upwards on the inclined plane.

K, Ties furnished with oscillatory joints at *k*, and connecting the crane to the posts L, which are to be firmly set in the ground within the rail-track.

M, The rails of the ascending rail-track, situated above the windlasses.

NOTE.—The only parts of the crane which will present themselves above the surface of the road, are the props, a portion of the frame, the ties, and the heads of the posts. The other parts, together with their adjustments, are to be situated in a pit, walled with masonry, and adapted in other respects for the reception of the crane.

FIG. 6.—A side view of the Rail-road Crane, showing the position of a carriage ready to be elevated by it. The explanations of all the letters of this figure, from A to M, inclusive, are the same as those used in reference to figs. 4 and 5, which see.

N, A chain to be acted upon by a wheel and windlass, or by a pulley power, whereby the windlasses FF are to be put in motion, by means of the branch chains *n*.

O, Segments of wheels receiving the action of the chains *n*, and communicating it to the windlasses, as before intimated.

P, Wipers, or excentric wheels, fixed to the windlasses, and receiving the friction wheels of the crane upon their peripheries.

Q, The friction wheels supplied with flanges or guides at their rims, to prevent them from slipping laterally upon the edges of the wipers.

q, Steps and bearings adapted to the reception of the friction wheels.

R, Props for sustaining the Locomotive Engine, when the crane is made to act upon it.

r, Sockets or steps attached to the frame of the carriage, and serving as receptacles for the heads of the props; the figure indicates a section through the centre of the sockets.

N. B. The crane, and the carriage, must be so adjusted to each other, that when the props are brought into close contact with their sockets, the wheel H may be in complete gear with the pinion C, and remain so when the carriage wheels shall have been lifted from the rails of the road.

OPERATION.

The chain N, being drawn upward, the wiper P will act upon the friction wheels Q; the frame E will be elevated, and the props R

brought into close contact with their sockets *r*, at the same time the cog-wheel H will be thrown into gear with the pinion C. Continue the draft of the chain N, till the carriage wheels A, are lifted from the rails M, the whole weight of the Locomotive Engine resting upon the crane. The steam engine being now put in action, as usual, on the road, the toothed wheel I, will revolve in such a manner as to draw the upper portion of the endless-chain *i*, in a direction corresponding to that of the carriages passing upon the rail-way. The carriages being now attached to the endless-chain by suitable fastenings, will be drawn upward on the inclined plane, towards the rail-road crane.

FIG. 7.—A view of the Hydraulic-Double-Brake, and some of its appendages.

S, A toothed, or cog-wheel, for the reception of the endless-chain of the descending rail-track, or plane.

s, A shaft, or axle, having a horizontal position, at right angles with the direction of the rail-track.

T, Vertical posts furnished with steps, in which the axle *s* traverses.

N. B. The posts must be so secured by means of stays, or otherwise, as to maintain their vertical position, however great the force acting upon the axle may be.

V, Trunks, or cylinders open at top, and furnished with a cock, or wicket, at bottom, through which a larger or smaller quantity of water, in due proportion to the action upon the shafts, may be allowed to pass.

V, Solid pistons, moving freely within the trunks.

W, Cranks, attached to the ends of the axles, and acting at right angles to each other.

W, Piston rods, connecting the pistons to the cranks.

NOTE.—The piston rods may either be inflexible, as represented in the figure, or may each of them be furnished with oscillatory joints, above that portion of the rod which enters the trunk. In this case, the joint must be adjusted with slides or other apparatus for maintaining a parallel motion.

N. B. When this machine is in operation the trunks must be kept full of water. For this purpose it may be adviseable to place the frame represented in the figure, within a well, or cistern, in which there should be a constant supply of water, sufficient to keep the whole of the trunks immersed considerably below the surface.

OPERATION.

The principle upon which the brake operates, is the resistance encountered by the pistons in their passage through the water contained in the trunks. This resistance will be greatest, when the cocks, or wickets at their bottoms, are shut.

The carriage about to descend, is hooked to the upper, or descending portion of the endless-chain. In its progress downward, it draws the chain with it, and thus gives motion to the wheel, S. The cranks, W, operate in such a manner, that, when one is passing the dead point, or point of no action, the other is at the point of greatest action. The agency of the cranks is counteracted by the resistance of the

Fig. 5.

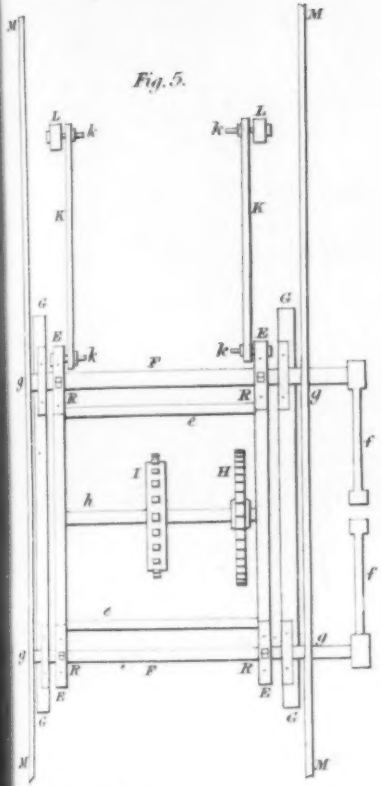


Fig. 8

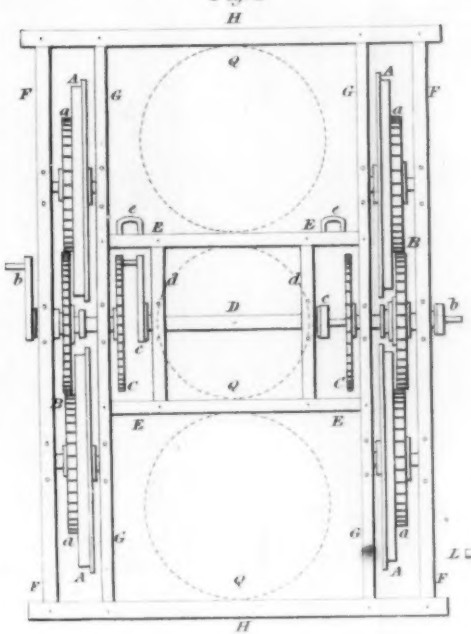
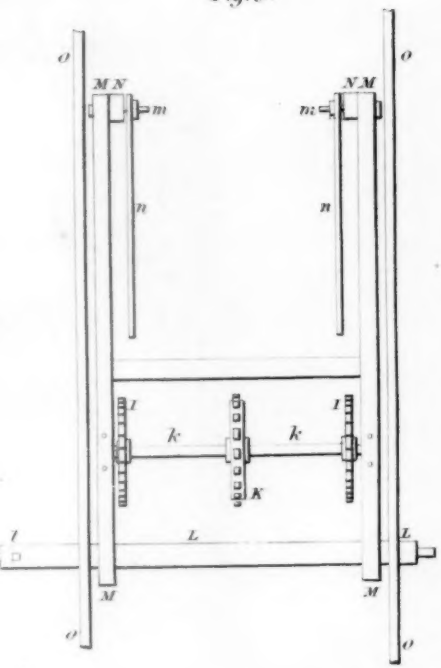


Fig. 9.



4th, The discovery, and application, of the Hydraulic-Double-Brake.

THIRD METHOD.

The method now under consideration, differs from that last described, in the construction of the carriage, and in the arrangement of the machinery of the Locomotive Engine, also, in the substitution of an appendage less complicated than the Rail-road Crane, in connexion with the endless-chain.

wickets at their bottoms, are shut.

The carriage about to descend, is hooked to the upper, or descending portion of the endless-chain. In its progress downward, it draws the chain with it, and thus gives motion to the wheel, S. The cranks, W, operate in such a manner, that, when one is passing the dead point, or point of no action, the other is at the point of greatest action. The agency of the cranks is counteracted by the resistance of the

pistons, which is thereby applied as a retarding power, to the descent of the carriages.

OBSERVATIONS.

It is assumed as a matter of fact, that a Locomotive Engine may be made to propel, on a horizontal rail-way, (without the intervention of a rack and pinion,) *its own weight*, and *eight times as much besides*. Also, that the same engine, exercising an equal degree of power, is able to propel *its own weight* upward, on an inclined plane, whose height is to its length, as 1 to 16½, nearly, or about three hundred feet to a mile, the rails being kept clear of mud and ice.

The method under consideration provides for the ascent of the Locomotive Engine by itself, and afterwards for that of the train of carriages, by applying the power of the engine to the endless-chain, through the medium of the machinery described under figures 4, 5 and 6.

The gearing of the machinery may be so adjusted, that the whole train of carriages may be drawn up at once; or should it be found more convenient, and less expensive, that a single carriage only, or any other portion of the train, may be drawn up at a time.

It is obvious that the crane must be appended to the ascending rail-track, and located at the head of the inclined plane, at such a distance therefrom, as to make room for the entire train of carriages to stand upon the horizontal way, between the plane and the crane.

The Hydraulic-Double-Brake must be located in the descending rail-track, near to the head, or foot of the plane, or both if required, and may be so adjusted, as to regulate the descent of one, or more, carriages at a time, as may be found most convenient. The chain, or other apparatus, connecting the carriages to the endless-chain that plies upon the brake, must be applied in such a manner that it will of its own accord, unhook, or disengage itself, at the moment when the carriage arrives at the foot of the inclined plane.

REMARKS.

The improvements, or discoveries, intended to be described under the second method, as comprehended in the foregoing essay, and claimed as original, and new, are—

1st, The mode of propelling the Locomotive Engine, and its train of loaded carriages, upward, on an inclined plane.

2nd, The mode of retarding loaded carriages, in their passage downward, on inclined planes.

3d, The invention, and application, of the Rail-road Crane.

4th, The discovery, and application, of the Hydraulic-Double-Brake.

THIRD METHOD.

The method now under consideration, differs from that last described, in the construction of the carriage, and in the arrangement of the machinery of the Locomotive Engine, also, in the substitution of an appendage less complicated than the Rail-road Crane, in connexion with the endless-chain.

The modifications of the Locomotive Engine, contemplated under this head, and those of the machinery, by means of which, the power of the engine is to be applied to the transfer of the train of carriages from a lower to a superior level, are to be considered in the following description of the machinery, and

EXPLANATIONS OF THE DRAWINGS.

Fig. 8. A view of the carriage of the Locomotive Engine, showing the position of the boilers, &c.

A, The carriage wheels, each of which is furnished with a short axle, traversing in steps attached to the carriage frame. *a*, Pinions, connected with the carriage wheels, being cast with them.

B, Cog-wheels, traversing upon their axles, to which they are connected by a sort of lock gearing, by means of which they may be made to revolve conjointly, or the axles may revolve, independently of the wheels, as the lock is applied to, or withdrawn from, the wheels. The lock is to be so adjusted, that it may slide freely on a square part of the axle, and embrace the arms of the wheel, B. *b*, Cranks, attached to the axles of the cog-wheels, B; and together with the crank-wheels, C, and the cranks, *c*, receiving the action of the steam engine, and communicating it to the carriage wheels by means of the cog-wheels, B, and the pinions, *a*.

C, Crank-wheels, serving to communicate the power of the engine to the cog-wheels, I, fig. 9. when in gear with the latter.

c, Cranks, situated at right angles to each other, and serving to equalize the action of the steam engine upon the carriage.

D, An axle, connecting the cranks, *c*, and traversing in steps attached to the carriage-frame.

E, Beams, or ties, connecting the sides of the carriage frame.

d, Timbers, for the support of the axle, D, and furnished with steps for its reception.

e, Staples, to receive the hooks of the rods, *n*, fig. 9.

F and G, Cheeks of the carriage, two on each side, furnished with steps for the reception of the axles of the wheels, A, and cog-wheels, B and C. The carriage wheels, &c. are to revolve freely within the cheeks.

H, Head-locks or transums, to which the ends of the cheeks are firmly attached.

Q, The places of the boilers.

Fig. 9. A view of the machinery substituted for the rail-road crane.

I, Cog-wheels, to receive the action of the crank-wheels, C, fig. 8, and communicate it to the endless-chain, by means of the toothed-wheel, K.

K, The toothed-wheel, adapted to the reception of the endless-chain.

L, A shaft, furnished with gudgeons, upon which it may traverse, and with wipers, or plugs, immediately below the cheeks, M. The shaft is to be furnished with a lever at *l*, by which it may be turned forth, and back, at pleasure.

M, Cheeks, receiving the steps of the axle, *k*. The cheeks are fur-

nished with oscillatory joints at N, where they are supported by a pivot, *m*, while at the other end they rest on the wipers of the shaft, L.

N, Posts, set in the ground within the rail-track. To these the cheeks, M, are attached, in the manner just intimated.

n, Rods, furnished with hooks at one end, and traversing on the pivots, *m*, at the other. The rods are to be adjusted in such a manner, that when the axle, D, (fig. 8.) is directly above the axle, *k*, (fig. 9.) their hooks may enter the staples, *e*.

O, The rails of the rail-road.

Fig. 10. A side view of the Locomotive Engine, and the apparatus employed in connexion with the endless-chain. The letters of this figure, from A to O, inclusive, refer to the same parts of the machinery as in figs. 8 and 9, which see.

P, One of the steam cylinders, supported on a frame work of iron suitable for that purpose, and firmly attached to the cheeks, F and G. Two cylinders, as usual, viz. one on each side of the carriage, are to be employed in this case.

P, The sweeps, or connecting rods of the steam engine, acting upon the cranks, *b*.

Q, Cylindrical boilers, each of which is composed of two cylinders of different lengths and diameters, having a vertical position. The shorter is included within the longer, allowing a space of about one foot between their heads, and of five or six inches between their sides. The interior of the smaller cylinders are to serve as fire-places, and are, accordingly, to be furnished with suitable grates at the bottom.

q, The doors, through which the fuel is to be administered.

r, The flues leading from the fire-places.

K, The chimney appended to the middle boiler, the interior cylinder of which is to be of equal length with the exterior.

S, Braces, for the support of the chimney, and the upper parts of the machinery.

s, A transverse bar, to which the braces are attached, and a band connected therewith for the reception of the chimney. The slides, or slide-bars, regulating the movements of the piston rods, are to be connected with this bar.

v, A dotted line, indicating the surface of the water in the boilers. *x* and *y*, The place of the endless-chain, the motion of which is in the direction from *x* to *y*.

In reference to the system of boilers herein proposed, a few remarks only need be offered on this occasion.—It will be perceived, that the intermediate, or centre boiler, is somewhat different from the others in its construction, the reason whereof, is, that it is not intended for the reception of fuel, but serves to unite the flues of both the others, in the following manner. From the openings, *r*, the flues lead downward between the middle and outside cylinders, communicating their heat to both, exteriorly. The flues then unite under the bottom of the centre boiler, and the draught is conducted upward through its interior, and passes off through the chimney. The combined heat of both flues will probably occasion a temperature nearly as high, in the middle, as that in either of the outside boilers. The chimney should

be of a diameter considerably less than that of the inner cylinder of the middle boiler, and should be inserted so far, that its lower extremity may remain below the line of surface water in the boilers. The space between the chimney and the cylinder, should be filled with a lute of fire-clay, or other non-conductor.

In order to adapt the boilers of the Locomotive Engine (constructed agreeably to the manner pointed out under this method) it was found necessary to assign to the middle boiler, a diameter, and length, considerably less than those of the others.

It should be observed further, that the flues between the boilers ought not to rise higher than the line of surface water at *v*, and that they should be walled, on those sides not contiguous to the boilers, with light sheet-iron, lined with fire brick, or suitably luted with fire clay. The flooring, or hearth, of the flues, occupying the whole distance between the two outside boilers, and placed so low as to allow a free communication with the interior of the centre boiler, should be constructed of sheet iron, overlaid with fire bricks, or lute.

Ash-pans of a suitable form and construction may be placed under each fire-place. These may be furnished with shutters, in a manner to exclude, or admit, the atmosphere into the furnace, at pleasure.

Another mode of damping the heat of the fire-places, is suggested, as follows. Let a thin plate of iron, large enough to cover the entrance of the flues into the middle boiler, be placed directly beneath the latter, resting upon the hearth of the flue. Let the plate be so adjusted, by means of a rod, lever, or winch, that it may be elevated till it comes in contact with the boiler, and depressed again at pleasure from without. The draught of the chimney may by these means be increased, diminished, or totally intercepted, as the nature of the case may require.

OPERATION.

In the ascent of inclined planes, the Locomotive Engine is to proceed upward by itself, to the site of the machinery represented in fig. 9. On arriving thereat, the hooks of the rod *n*, are to be applied to the staples *e*. Let the shaft L, be turned by the lever *l*, till the cog-wheels I, are thrown into the crank wheels C. Let the locks be slipped from the wheels B, either before or after the preceding operation. The power, or action, of the steam engine, will then be applied to the endless chain *x y*, and the train of carriages drawn upward, in the same manner as represented, agreeably to the second method.

The mode of descending inclined planes, is precisely the same as that contemplated under the method just cited.

REMARKS.

The improvements intended as the subject of description under the third method, and claimed as new, and original, are as follows, viz:

1. The mode of applying the power of the steam engine in propelling the Locomotive Engine and its train of carriages, together with the arrangement of the machinery for the accomplishment of those objects.

LONG'S LOCOMOTIVE ENGINE

Plate 3.

Fig. 6.

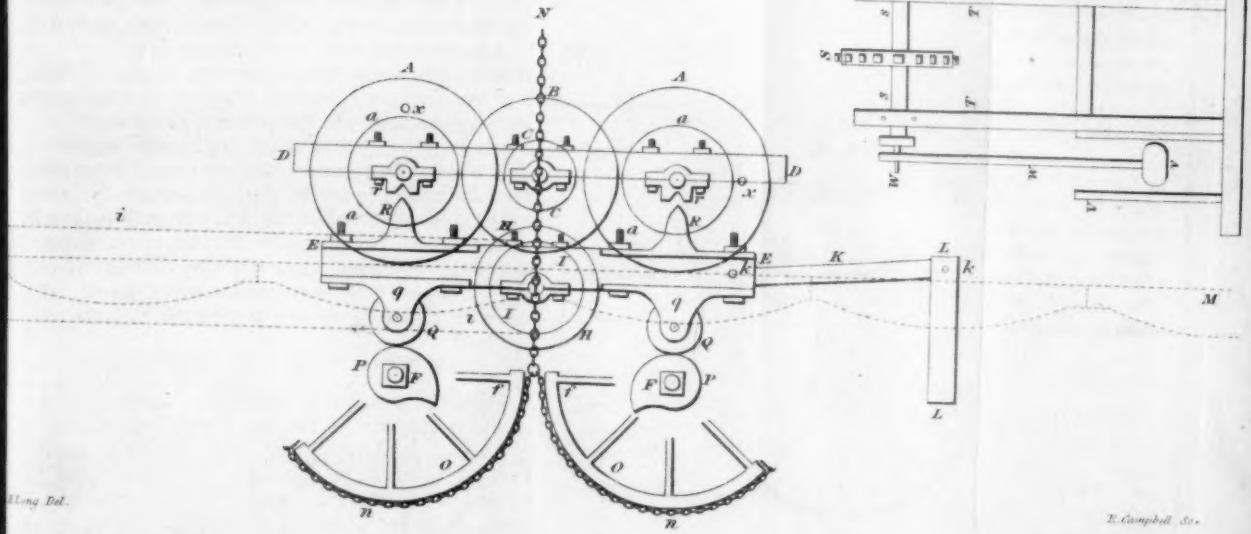
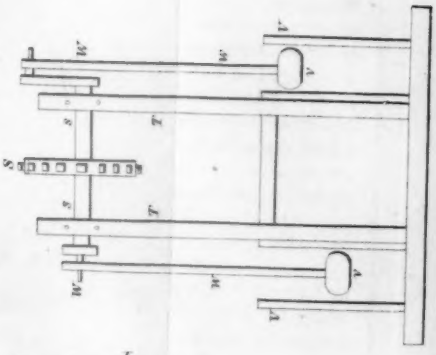


Fig. 7



E. Campbell Sc.

be of a diameter considerably less than that of the inner cylinder of the middle boiler, and should be inserted so far that its [illegible]

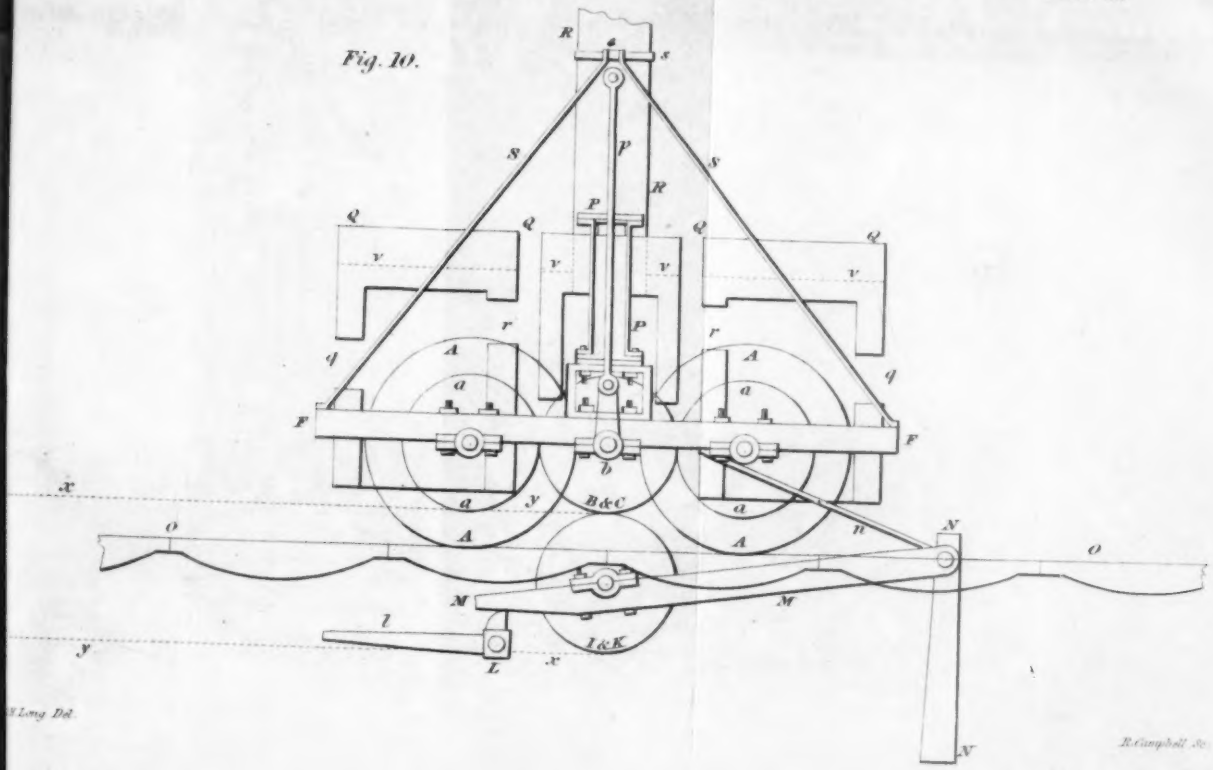
The improvements intended as the subject of description under the third method, and claimed as new, and original, are as follows, viz:

1. The mode of applying the power of the steam engine in propelling the Locomotive Engine and its train of carriages, together with the arrangement of the machinery for the accomplishment of those objects.

LONG'S LOCOMOTIVE ENGINE.

Plate 4.

Fig. 10.



H. Long Del.

R. Campbell Sc.

The improvements intended as the subject of description under the third method, and claimed as new, and original, are as follows, viz:

1. The mode of applying the power of the steam engine in propelling the Locomotive Engine and its train of carriages, together with the arrangement of the machinery for the accomplishment of those objects.

2. The adjustments, and application of the gearing, connected with the endless chain.

3. The construction, and arrangement of boilers, or steam generators, adapted to the use of anthracite, or other coal, as fuel.

An Essay on the Bombyx Mori, or Silk Worm, read before the Macurean Lyceum of Science of Philadelphia, June 11th, 1826. By JOHN T. SHARPLESS, M. D.

(Continued from p. 100.)

In my remarks upon the propagation of the mulberry tree, I shall first describe the plan pursued by the Chinese. After the seeds are prepared, they soak them in a lye of the wood of the tree, and sow them in rows, in the spring, in ground which is rather moist, and has been long uncultivated, but which has been prepared, and well manured with ashes, or the mud from rivers or marshes. In January following, they trim off all the superabundant and crooked branches, and leave only those that are straight, and which stand at some distance from each other, permitting but four eyes to remain on them; and that the air and sun may have free access to the centre of the bush, they make it quite hollow within. The forked and crooked stems, are cut off close to the ground, that they may put forth straight. After the first year, the main shoot is not touched; but the side ones are kept close, till the tree has gained the full height of five or six feet. They should be transplanted in the second year, at a distance of eight paces; and when they have arrived at their height, the top should be cut off, and the side branches allowed to grow, till they form an inverted cone; every part of which, should be accessible to the gatherer. They are careful to remove all the fruit as soon as it appears; considering it as a useless consumer of the powers of the plant; but they are extremely careful to leave sufficient leaves to carry on the vegetative process, even on the oldest of their trees. When the tree becomes old, and its resources evidently exhausted, it is, in the spring, cut off near the ground, and a graft set in; or if merely a limb becomes withered or dead, it is removed, and a new bud put in its place. By these means, they are preserved from fifty to one hundred years. The Chinese also propagate the tree by the slip, or by bending long branches down, into the ground; and when these have taken root, they are separated from the parent tree. Loureiro states, that in Cochin China, the whole plant is rooted up every third year, and fresh plantations made of the cuttings, under a belief, that the very young shoots produce the finest silk.

In France and Italy, according to Sauvage, Count Dondola, and M. Thomé, the seeds must be sown in July, August, March, or April, in good ground, not too dry. But a better plan is, to place the berries themselves in the earth, either by simply covering them up, or by mashing them on a hair clothes line, till they stick in considerable quantity, and then laying it in a trench, and covering it with earth.

The pulp of the fruit, in this case, forms a constant source of nourishment, till the seeds sprout. For the first three years, the defective, and crowded sprouts and branches, are removed; at the end of this time, the faultless shoots are taken up, the long, tapering, main root, is cut off, that the side ones may grow, and are then transplanted 1½ feet apart. If ingrafting is not practised, the trunk is cut off, so that but one eye remains; this is treated as though a graft had been set in. It has however been found, that ingrafted trees are much the most productive of good leaves, though less durable; the natural trunk living sometimes nearly 100, whilst the artificial branches seldom endure more than 10 or 12 years. If the plan of ingrafting is followed, the graft should be set in after the first transplanting in July; a good stock should be selected, and cut off, to within two inches of the place of the graft, which must be as near the ground as possible; and when it has well sprouted, the remaining two inches should be cut off, that the shoot may grow straight. In March, or April, following, the trunk must be trimmed, that the height may be increased; and when it has grown to 6 or 7 feet, the top must be removed, and the bush treated as by the Chinese. In the fifth year from the seed, the trunk is generally about two inches in diameter, and must be placed in a permanent situation. The land best adapted for this last change, is such as is usually denominated good grain land, which should be broken up, several months before the time of planting. The holes must be made large, and about thirty feet apart, and nearly filled with good manure. The bushes should be taken up in a damp day, and all the roots cut off, to within six inches of the main root. After they are planted for the last time, the ground at the foot must be shielded from the sun, by straw, till it has taken hold of the earth.

In the Isle of France, M. Chazel allowed three feet distance between each plant, and permitted them to grow but five feet high, cutting them down near to the ground, every few years. In England, the modes pursued, have been similar to those described. In Pennsylvania, the tree had been allowed to grow to its full size, without any care, until a system was introduced by the late Mr. Paul Busti. He planted the fruit about three inches apart, and covered them with a thin coat of earth, and then a layer of soot, plaister, or lime; and in the second year, selected the good shoots for transplanting. His mode of ingrafting, was rather unusual, and perhaps unnecessarily troublesome. He chose a good trunk of a wild tree, of small size, whilst the sap was in full run, and having cut it down to within six inches of the ground, he denuded it of its bark for one or two inches, by a cut perfectly smooth, that the capillary vessels might not be injured. From a limb of the same size as the tree he wished to propagate, he then cut in the same way, and twisted off, a cylinder of bark containing several eyes. This was slipped on the denuded trunk, and the cut edges made to fit exactly, and the joint and end, closed with soft clay.

Mr. John Fitch, of Mansfield, Con. in a letter to me, says, the ordinary mode of procuring leaves there, is from the tree raised in a nursery, from the seed, and transplanted; the sowing and mowing system having failed, from the early death of the roots.

Mr. E. C. Genet, of Albany, whose communication to the committee of Congress was printed in their report, has kindly obliged me with a long description of the plan he has observed to be most successful. He says he is perfectly confident, that the mode pursued in some parts of France and China, of keeping the bushes low, and in hedges, is the best; that they shoot much earlier in the spring, are more readily protected from the frosts, give a much greater quantity of the most luxuriant and nourishing leaves, and are much more easily gathered. They should, however, be kept under constant irrigation; and with care, will last a long time. He says, the plant may be raised from the seed, or slip; when the latter are used, they should be thrifty sprouts, one and a half feet in length, and planted late in the fall, in a good light soil, well prepared by deep digging, and manuring; and adds, "if that light, sandy, black mould, called by the French, *Terre de Bruyere*, or heath soil, and much employed by the gardeners of that country, was used, success would be infallible."

Of all authors I have read on the subject, no one has given so particular, and, perhaps, so correct a history of this matter, as the Rev. Mr. Pullein, and the succeeding remarks on the subject are collected from his work. He mentions the preceding plans, but considers, *that* from the seed the most rapid, and perhaps the best that can be pursued. He recommends that the berries be mashed on a hay rope, and laid in a trench and watered; the hay, as it rots, becoming good manure for the roots. He thinks seeds that have passed through the body of some animal, shoot much sooner than others, and proposes that they be mixed with flour, and given to dogs, and the dejections of the animal planted, surrounding the seed. The soil best adapted to the plant, however it be cultivated, is a loose, rich mould, inclining to sandy, and under which is gravel rather than clay, as the latter holds the wet, and chills the young plants. It should also be deep, as the roots shoot much downward. The seed must be sown as early as the ground can be broken in the spring, and watered every second day, and a layer of fine coal or soot, placed on the bed, will retain the heat of the sun, and facilitate the sprouting. They should now be watered and hoed frequently, to destroy the weeds and slugs that infest the roots, but he proposes to keep off the worms by a layer of soot around the stems, or, by a horse hair rope, with the hair projecting, and cut short; this annoys the animals, and they soon disappear.

The next most easy cultivation is from the cuttings. These should be large branches, three inches in circumference, with many side shoots. Limbs from old, and even superannuated trees, will answer every purpose; and may be three or four feet long. The cut ends are to be dipped in tar or pitch, or seared with a hot iron, to keep out the moisture of the earth, and then laid in deep trenches; this should be done in autumn, and in land that has been broken up, and enriched with manure, or loam, some weeks before. These trenches should run from north to south, and be about four feet apart, that the rows may not shade each other. The side shoots ought to be bent up, so as to project about six or eight inches above the ground. If the winter is severe, cover the shoots with straw, and be careful that cattle do not

eat them off. In two years, with attention, they may be separated from each other, and transplanted into regular hedges, running in the same direction. He thinks they should now be kept flat by sticks, run through them, like espaliers; and the branches that project at right angles cut off.

He also proposes dividing large roots into small pieces and then planting them.

After transplanting, they are permitted to grow only to a height of six or seven feet, and must not be robbed of their leaves before the fourth year. The great advantages of planting the hedges to run from north to south, and of laying them flat, are, that the sun has free access to all parts of the bush, and by shining on the whole of one side early in the morning, the leaves are dried, and fit for food much sooner. The roots are also much more exposed to the rain, from the small space covered by the tree.

When the leaves are gathered, it should be by those who do not use tobacco or garlic, and they must have clean hands: they should not be rudely pulled off the limbs, but each bunch removed without mashing, or the branch be cut off with a sharp knife, with the obliqueness of the cut presenting downward, that the wet may not get in. After being gathered, they must not be crammed tight into a bag, but left loosely in baskets, and turned over frequently that they may not become damp. The food for the day should be collected in the morning, for the noonday sun withers the leaves, and makes them less suitable.

Mr. Pullein proposes a plan for the cultivation of the worm, but which he had never tried; it is to allow the worm to take care of itself, on a tree, to ascertain if a better breed might not be raised. He advises, to select several young, healthy bushes, and plant them in large boxes, placed in the house, but exposed to the air. These, if necessary, may be covered by netting, to keep off the insects; and he proposes to water them by a rope of tow round each principal branch and stem, the ends of which is placed in a vessel of water, the capillary attraction supplying the tree with moisture.

It is, perhaps, impossible to judge which of the plans, heretofore mentioned, would be the most adviseable for this country; all may be tried, and experience will best decide. It is requisite to discover the quantity of leaves that can be raised, or rather, how many worms may be fed, and how much silk produced from a given portion of land. The accounts of the most respectable writers differing so much, that little certainty can be gained from the evidence now before us; witness the discrepancy in the relations of Mr. Fitch, and Mr. Genet, published last spring, in the report of the committee of congress. Mr. Genet says, "one twentieth of an acre planted with bushes not more than three years old, will supply one hundred thousand worms, and will produce thirty pounds of drawn silk; and if a whole acre be so planted, the product will be six hundred pounds, which is worth, at present, three dollars per pound." At this calculation, one acre will supply two millions of animals. Mr. Fitch states, that "one acre of full grown trees, set one and a half rods apart, will produce forty

pounds of silk, which is worth five dollars the pound, making two hundred dollars." Here then is the great difference of one thousand six hundred dollars in the product of a single acre. Mr. Genet continues, "forty thousand worms will consume one thousand pounds of leaves, easily supplied by fifty grown, or two hundred small trees, of two or three years; and the produce will average twelve pounds of drawn silk, allowing for contingencies." Anxious to ascertain the cause of this apparently enormous inconsistency, I took the liberty of writing to both the gentlemen, and they kindly sent the following replies. Mr. Fitch says—"The estimate I gave is about the average that can be obtained, though there is one tree, in Mansfield, that has yielded four pounds of silk. This luxuriance depended on its location, being near the house, in good soil, and receiving the wash thrown out." Mr. Genet declares that from his "experience and observation, mulberry trees, trimmed down every year near to the ground, as is practised in the willow for baskets, will yield much more than if placed in orchards, to grow to a full size. The most correct calculation is, that fifty trees, of twenty-five or thirty years of age, will produce, with proper care, nourishment for forty thousand worms, and will yield but eight or ten pounds of silk." After stating that an advantage is gained with the trees, by making use of the ground under them, he continues, "whilst one hundred trees raised in that way, which may occupy one acre, will make but twenty pounds of silk; I am confident, if the shrubbery, or hedge system is pursued, the quantity mentioned in my report to congress, may be procured." According to these accounts, and we cannot doubt the evidence of gentlemen so respectable, the plan of Mr. Genet is decidedly preferable, and the particular manipulation of this style of cultivation is perhaps stated most correctly by Mr. Pullein.

The late Mr. Busti planted and engrafted many hundred trees, most of which, however, have been since destroyed. Mr. Dusar, who also deserves the gratitude of his fellow-citizens for his assiduity in propagating a knowledge of the mode of managing the worm, has now under cultivation, a large quantity of trees of the best quality.

The actual quantity of leaves consumed by the insect is also a matter of some consequence. Count Dondola, who has probably made the most minute enquiries on the subject, says, "The quantity actually consumed by five oz. of ovæ, or two hundred thousand worms, is, in

the	1st age	20 lbs.
	2nd do.	55
	3d do.	216
	4th do.	620
	5th do.	3,820
		4,731

"This, with the waste, will make five thousand four hundred pounds of leaves." He also states, that "one hundred eggs will weigh but one grain, and that number of worms in thirty days will weigh nine thousand five hundred grains."

I will conclude with a few remarks on the number of persons re-

quired to attend a certain quantity of animals, and reel the silk. In the directions printed by the 'Filature of Philadelphia,' it is said, that when the trees are convenient, two persons will attend and feed six oz. of eggs, or two hundred and forty thousand worms, until ten days from spinning, when five or six active children will be necessary. Mr. Fitch considers but one person necessary for the first three weeks, to attend one hundred and thirty thousand, and for the following fifteen days, or till they spin, five persons, chiefly women and children. Care should be taken to prevent the possibility of neglect, from inattention, or sickness in the tenders; for twenty-four hours starvation, will annihilate the most promising prospect. With regard to the reeling, the gentleman just mentioned, estimates the labour of five persons, for fifteen days, amply sufficient to pick off and reel forty pounds of silk, or one hundred and thirty thousand cocoons. Mr. Peter Nouailles, of Kent, says, that the women of Novi in Italy, can, with the assistance of a girl to turn, reel off, per day, one pound of silk of the first quality, of five threads, with two skeins on the wheel at once; but when she is allowed to put five or six skeins on, she can reel off six or eight pounds, of bad, rough silk.

With all our present exertions, raising silk will never prevail to the extent to be desired till markets are established for the produce. The poor, and labouring classes, should be encouraged to undertake the culture, but can they send their silk to England to be throwsted and woven? They can hardly possess the conveniences for reeling. Societies should be established, similar to the Filature of 1770, and sufficient capital be devoted to the purchase of cocoons, or reeled silk; let them procure machinery and workmen to manufacture the article, and then a certain return for their labour will induce the industrious classes to join in the business.

Why should England, France, Italy and China enjoy alone, an immense revenue arising from a source of wealth so completely within our power? It is a subject of national importance, and well deserves all the encouragement congress can bestow upon it.

NOTE.—In the first section of this article, I mentioned, that Mr. Miner had introduced his motion in Congress, at the suggestion of Mr. Alexander. Into this error I was led, by seeing a letter from Mr. M. to Mr. A. after that motion, in which he says, the nation is more indebted to Mr. Alexander, than to himself, for the introduction of the worm to public attention. This communication, I supposed, was an answer to a letter, in which Mr. A. had urged the resolution. The high respect I feel for the distinguished talents, and patriotic exertions of Mr. Miner, has induced me to embrace this opportunity, of giving the credit where it is due. I have been informed by one of his particular friends, since the publication of the first section of this essay, that the act was solely the result of his *own* mature judgment, having long since shown himself deeply interested in the matter, by his writings and conversation.

FRANKLIN INSTITUTE.

Report of the Committee of Inventions, on an improvement in the Fire-ladder, for which improvement a patent has been obtained by SAMUEL LEHMAN, *of the city of Philadelphia.*

The Committee of inventions, having had referred to them for their examination, a model of an improved fire-ladder, invented by Mr. Samuel Lehman of this city;

Report, that they have attended to that duty, and that the following is the construction of the machine. The ladder is divided into two parts, each ordinarily to be about twenty-five feet in length; the lower section lies upon a strong carriage, to which it is affixed by a hinge-joint; upon this, is placed the upper section, which is retained in its place by iron hooks or clips, which allow it to slide upon the lower section, so that it may be drawn out, and with the lower section, form, when elevated, a ladder of about forty feet in height, a sufficient lap being allowed, to insure the necessary strength. The carriage has two wheels at its forepart, and at the other end there are projecting handles, or shafts, with legs, or supports, the whole being similar to those of a common wheel-barrow, or truck, with two wheels. The ladder is so balanced upon its carriage, that the handles may be lifted, and the whole guided by a man of ordinary strength, whilst three or four persons may draw it by means of ropes, attached to it for that purpose.

In order to elevate the ladder, a windlass is affixed to the under part of the carriage; and two posts, firmly braced, are mortised into the upper part of the frame, near the foot of the ladder; these rise, perpendicularly, to the height of seven or eight feet, and have sheaves at their upper ends, round which pass ropes from the windlass, the ends of which ropes, are attached to the lower section of the ladder, seven or eight feet from the hinge-joint. On turning the windlass the ladder will be elevated, and when raised to the proper angle, it is sustained by means of two long braces, or arms, attached to it by staples, the lower ends having iron straps, with holes which slip on the extremities of the axle-tree.

The upper section of the ladder is made to slide up by means of a second axle, under the carriage, the rope from which passes over a roller at the upper end of the lower, and is attached to the foot of the upper section; by means of this it may readily be forced up to the requisite height.

There are some other appendages, which being of minor importance, it is not deemed necessary to describe. The whole manifests considerable ingenuity, and the parts are well arranged. The Committee, however, are of opinion that it is too bulky for use in a large city, where ground is valuable, as it would require a house nearly thirty feet in length, about eight in width, and ten in height; this they apprehend will operate as an insuperable objection to its adoption here, especially, as the means already possessed by us of extinguishing fires, are of the most efficient kind, and the common ladder is very rarely used. There are, undoubtedly, many situations in which

such an instrument may be very advantageously employed, not only in cases of fire, but also for attaining different elevations by means of the same ladder, which may be easily raised and removed. The Committee have not thought it necessary to notice certain apparatus heretofore invented, with similar views, as they are not acquainted with any which materially interfere with the arrangement of that now under consideration.

By order.

THOMAS P. JONES, *Secretary*.

Philadelphia, August 19th, 1826.

FOR THE FRANKLIN JOURNAL.

EDUCATION IN MEXICO.

Extract of a letter from a distinguished Member of the Franklin Institute, now in Mexico.

In the city of *Peuebla de los Angeles*, on the route from Vera Cruz to this place, there is a society formed, for the dissemination of education, to all classes of the community. The short stay I made in that city, did not permit me to obtain a full knowledge of the principles upon which it is formed; but I was told, that it supported an elementary school, (*de primeras letras*) in which, about 500 boys are gratuitously taught reading, writing, &c. and connected with this, is a drawing school, in like manner, gratuitous; in which, about one hundred pupils are instructed. From the drawings which I saw, I was satisfied that some of them had made great progress. I was informed, that the scholars remain as long as they please in the school. No false pride prevents the rich (who are members of the society) from sending their sons to this school, to be instructed with the poor. It is gratifying to add, that notwithstanding all the abuse lavished upon the catholic clergy, as inimical to the diffusion of education, this society has been in a great measure supported by the liberal zeal of the Bishop, and of another respectable prelate, who is at present in his 80th year, and whose whole life has been devoted to the extension of learning, and to the diffusion of the principles of equal rights in all men. The society appears to include many objects, which, with us, would be divided between many. To promote the public good, by educating the poor; to encourage the fine arts; and to extend support to the useful arts, are, however, its principal objects.

In that city there are many manufactories, principally of Cloth, Cotton, Pottery, Glassware, &c. I visited many of them, and intended to prepare a notice of them for our Journal; but my stay there was too short, to allow me to do justice to the subject. Their pottery is remarkably good; I can assure you, that I wish we could have shown at our late exhibition, any that could compare with that made in this country.

MEXICO, May 23, 1826.

Letter from ROBERT HARE, M. D. *Professor of Chemistry in the University of Pennsylvania, to Dr. Thomas P. Jones, Editor of the Franklin Journal, containing observations on the explosions which have taken place in the boilers of steam engines.*

Dear Sir,—It has been suggested that some extraordinary evolution of the gaseous elements of water, or even an inflammation of aqueous vapour, may have contributed to the explosion of the boilers of Steam Engines, especially in the instance of the Steam-boat Ætna. You are desirous that I should communicate, for your Journal, a confutation of these impressions, so inconsistent with any accurate knowledge of the subject.

I have always been of opinion, that the accident on board of the Ætna, arose from the overheating of one of her boilers, while insufficiently supplied with water. That iron heated to redness, may be sundered by a force, to which it would not otherwise yield, seems to be justified by the well known power of heat in lessening the tenacity of metals. But whether this impression be right or wrong, I am decidedly of opinion that it is inconsistent with science, and unnecessary, to suppose any other agency in water, in the case in point, than that arising from its conversion into steam under confinement.

The Ætna was alleged to work, at times, with a pressure of one hundred and fifty pounds per square inch. In a boiler of twelve feet six inches, or one hundred and fifty inches long, and two feet nine inches in diameter, or one hundred inches in circumference, the number of superficial inches will be fifteen thousand; this multiplied by one hundred and fifty, gives a total of two millions, two hundred and fifty thousand pounds, as the total power to be restrained.

The sudden liberation of such a force, to act upon bodies around it, was far more than competent to produce all the dreadful features of the catastrophe, which happened on board the steam-boat above mentioned.

The conflagration of the gaseous elements of water, produces a more intense heat than any other combustion. This is ascribed to the evolution of an excess of caloric, which they hold when in the gaseous state, above that which they retain when forming aqueous vapour; and to the same cause we must attribute the violent explosion, which ensues, when a mixture of them is ignited, and thus transformed into steam. But if, during this union, these elements give out caloric, during their disunion, it must be absorbed by them. If expansion ensues in the first instance, condensation ought to take place in the last. Besides what is there, within a steam-boiler, to cause their disunion? The red-hot iron may decompose the steam slowly, but it can do so only by absorbing the oxygen, which must lessen the quantity of elastic matter in the boiler, and render the evolved hydrogen gas, inert; as, by itself, it cannot explode.

That water can become susceptible of inflammation, is inconsistent with all that I know on the subject. When passed over ignited anthracite, or coak, or mixed with inflammable carbonaceous vapours, it

may, by its decomposition, yield hydrogen, while its oxygen uniting with the carbon, forms a gaseous oxide of that substance, which is susceptible of inflammation. But, in this case, it only substitutes one species of fuel for another. It neither augments the quantity of the fuel, nor the extent of the rarefaction.

It will be highly important to improve the means of indicating that deficiency of water, which permits the boiler to be unprotected by this fluid, in the part exposed to the fire. If the impression be correct, that a boiler may be weakened, by being heated to redness, I would employ the following contrivance.—A hollow globe being allowed to swim on the water of the boiler, should open a small cock, so as to produce a jet of steam in front of the boiler, whenever the water should sink too low.

While I coincide in the opinion, that overheating may be one cause of explosion, I am far from considering it as the only source of danger. A high pressure boiler, in England, although immensely strong, was burst, in consequence of the valve being fastened down by one person, while the engine was stopped by another. The late explosion in a boat on the Susquehanna, has been attributed to a like cause.

In steam-boats, as in other vessels, our safety will depend upon the prudence and vigilance of the captain, and the discipline established among the crew. Steam-boats will be blown up, sail-boats will be upset, and stages run away with, broken down, or overturned, in despite of any preventive. Nevertheless, as accidents in the case of steam-boats, will be less destructive in proportion as less pressure is used, it would seem imprudent to extend it beyond eight pounds per square inch. This has been proved adequate to give a velocity of eleven miles an hour to a properly constructed boat,* and even this pressure would be sufficiently great to scald persons whose duty obliges them to be about the engine, though not generally injurious to the passengers. A valve loaded by a public officer, and left by him in an enclosure under his seal, would be the most effectual security.

I am sir, with due consideration,
Your obedient servant,

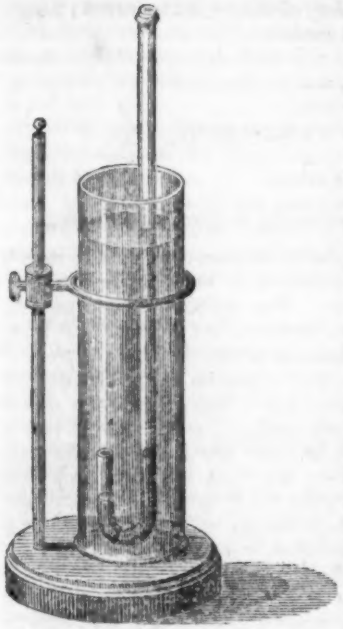
ROBERT HARE.

FOR THE FRANKLIN JOURNAL.

ILLUSTRATION OF ATMOSPHERIC PRESSURE.

In a former number of the Journal, we gave a demonstration of the pressure of the atmosphere, illustrated by cuts; which was, no doubt, satisfactory to most, if not all of our readers. Possibly, however, to some, the subject may be rendered still more intelligible, by means of the following illustration, which we also owe to Professor Hare.

* The *Trenton* of Philadelphia, which is, I believe, the quickest boat in this, or any other country, unless excelled by another, since constructed, under the same ingenious engineers, the Messrs. Stevens.



If a tube, recurved into a crook at one end, so as to form a syphon, with legs of very unequal length, and both ends open, have the crook lowered into water, as in the adjoining figure, the fluid will, of course, rise within the tube, to the same height as without. But if, before the crook is sunk into the fluid, it be occupied by mercury, the water will enter the tube, only so far as the pressure which it exerts upon the mercury in the shorter leg of the syphon, is competent to raise the mercury in the other.

This pressure, or the effort of the water to enter the tube, is obviously measured by the height to which it forces the mercury, in the longer leg of the syphon, above the mercurial surface, in the shorter leg. The height will of course be greater, or less, in proportion to the depth to which the lower surface of the mercury may be sunk. It will also be greater or less, accordingly, as the fluid in which it is immersed, is heavier or lighter. Hence, as water is about 820 times heavier than air, a depth of 820 inches in air, would displace the mercury, as much as one inch in water.

Let us imagine a tube recurved at one end, similarly to the one represented in the preceding figure, (the crook likewise occupied by mercury) to have the upper orifice as completely above the atmosphere, as the orifice of the tube is above the water in the jar. The mercury, in the shorter leg of the syphon, thus situated, would be evidently exposed to a pressure, caused by the air, analogous to that sustained from water, in the case of the tube, as already illustrated: and this pressure of the air would, as in the case of the water, be measured by the rise of the mercury, in the longer leg of the syphon.

It is obviously impossible to realize this experiment, with a syphon, reaching above the atmosphere; but, as the only motive for giving such a height to the syphon, is, that the mercury in one of its legs may be inaccessible to atmospheric pressure, if this object can be otherwise attained, the phenomenon may be exhibited in the case of the atmosphere, without any material deviation.

In fact, to protect the mercury in one of the legs, from atmospheric pressure, we have only to seal, and fill it with mercury, before we place it in a vertical position. We shall then find, that the pressure of the air on the mercury, in the open leg of the syphon, will support

a column of this metal in the other leg, of nearly thirty inches; though occasionally varying from 27 to 31 inches.

ON JAPANNING AND VARNISHING.—No. 3.

BY THE EDITOR.

To rub down, or prepare the varnished surface, for polishing.

For ordinary purposes, shell-lac varnish does not require to be rubbed down and polished, but where it is wished to have the surface very even, these processes are necessary. For rubbing down, pumice-stone, in fine powder, is used. Four or five coats of varnish, at least, must be laid on, and allowed to become perfectly hard; a piece of woolen rag may then be made wet, and a portion of the powder put upon it; this is to be rubbed carefully, and equally over every part of the varnished surface, until it appears perfectly even. Great care is requisite to avoid rubbing through at some parts, before others are rendered smooth, particularly if there are sharp edges, or projecting mouldings. When this takes place, the whole process of varnishing must be repeated; a little practice, however, will enable any one to avoid this, provided the article varnished, has an even surface, and the number of coats have been sufficient to give the requisite thickness of resin. When the surface, to be polished, is flat, the cloth may, when used, be wrapped round a piece of cork or wood; and the same method may be adopted in rubbing down mouldings.

To polish the varnish.

When the surface is well prepared by the pumice-stone, it is very easily polished. This is effected by fine rotten-stone, used exactly in the same way with the pumice-stone, excepting that sweet oil is employed, instead of water. The oil may be removed from the surface by a fine rag, and some dry rotten-stone; and if a little is then rubbed on by the palm of the hand, this will give the highest possible polish to the surface.

To prepare the rotten-stone.

Rotten-stone is sometimes harsh and gritty; the best way of trying it, is to take a little between the teeth, when the least portion of grit may be discovered. Careful workmen always wash it before they venture to use it. This is effected by stirring the fine powder in a considerable quantity of water, then allowing it to remain at rest for a few seconds, and pouring the water into a glazed earthen vessel; the powder which then precipitates will be perfectly fine and smooth; by washing the remainder, the whole of the finer parts may be separated from the grit.

The gloss upon shell-lac which has been polished, is less brilliant than that of the unpolished varnish, but this gloss may be given by a single coat of *seed-lac* varnish, which will abstract but little from the perfect surface given by polishing.

Black shell-lac varnish.

Shell-lac varnish may be rendered black, by mixing with it, either ivory, or lamp-black. The editor has frequently used, and always preferred, the latter. It should not be used as sold in the shops, being then greasy, as the workmen call it, and will neither mix or dry, well. Sometimes the lamp-black contains particles of plaster, from the walls of the chambers in which it is made; this, of course, should be rejected.

To prepare lamp-black for use.

Press a portion of it, into any earthen, or metallic vessel, which may be made red hot in the fire; for small quantities, a tobacco pipe, a piece of a gun barrel, or any other metallic tube, will answer the purpose perfectly well. It is not necessary to close the vessel, but the powder should be well rammed in; place the whole in an open fire until it is red hot throughout; this may be known by the lamp-black ceasing to flame at the exposed parts; take it from the fire, and allow it to become quite cool before you remove it from the vessel, otherwise it will burn into ashes. Lamp-black, thus prepared, will mix readily with water, will dry well in paint or varnish, and will be improved in colour.

To mix the colour with the varnish.

Rub the lamp-black up with a little alcohol, spirits of turpentine, or weak varnish, taking care to make it perfectly smooth before putting it into the cup with the varnish. To give a good black colour, the quantity of lamp-black must be considerable; this, it is true, will lessen the brilliancy of the varnish in some degree, but a thin coat of seed-lac, will diminish this fault. When only a small quantity of black varnish is wanted, it may be made by dissolving black sealing wax in alcohol. Sealing wax being composed principally of shell-lac. But little heat should be employed, or the black colour will be precipitated.

Shell-lac varnish of various colours,

May be made by mixing strong body colours, in fine powder, with the varnish, levigating them in the same manner as recommended with the lamp-black. None but full, deep colours will answer, as the colour of the varnish will deteriorate all those which possess any transparency, or which are of a light shade.

Red shell-lac varnish,

Is best made from good Dutch sealing wax. This is the kind used to varnish glass, and wood, for electrical purposes. Three or four coats will make a perfect covering.

Of the brushes used in varnishing.

It has been already remarked that the painters' sash-tool, makes a very good varnish brush for common purposes; for large articles, however, the flat camels-hair brushes, made for the purpose, are to be preferred; they are to be obtained from half an inch, to four inches in width, at most of the drug stores; for smaller sizes, round brushes, with tin tubes, are to be preferred.

It is a common practice, when the same brush is always used with the same kind of varnish, to allow it to dry with the varnish on, after scraping the brush on the edge of the cup; in this case it must be allowed to stand in the varnish for a few minutes to soften before using. It is a much better practice, however, to wash the brushes clean in spirits of turpentine, or in alcohol. When washed in the latter, the alcohol need not be wasted, but may be poured into the varnish bottle. For coloured varnishes, kept in small quantities, the brush may be left in the bottle; but in this case the cork should be perforated so as to fit the handle, and the points of the hairs should dip into the varnish; it is then always ready for use. A common mustard bottle will, in general, answer the intended purpose.

Of the French polish, by means of shell-lac varnish.

There is a mode of using shell-lac varnish, which is sometimes denominated the French, and sometimes the German mode. To whomsoever it is due, it merits to be generally known, as the process is easy and economical, and the effect beautiful. It has been much employed by cabinet and musical instrument makers, but is yet not so extensively practiced as it merits to be.

The varnish is to be prepared in the way already directed, and is used of a moderate thickness. The article to be polished must have a smooth even surface, such as is left by fine glass-paper, usually called sand-paper.

Mode of applying the varnish.

The varnish is applied by means of what is called a rubber; this is frequently made by rolling up a strip of thick woolen cloth, which has been torn off, so as to form a soft elastic edge; thick, wide list will answer perfectly well, although a greater width is more convenient to hold. The coil may be from one to three inches in diameter, according to the size of the work.

(From Gill's Technical Repository.)

"*On the manner of applying the varnish.*—The varnish, put into a narrow-mouthed bottle, is to be applied to the middle of the flat face of the rubber, by laying the rubber upon the mouth of the bottle, and quickly shaking the varnish up once; as the rubber will thus imbibe just a sufficient quantity to varnish a considerable extent of surface. The rubber must then be inclosed in a soft linen-cloth, doubled; the remainder of the cloth being gathered together at the back of the rubber, to form a handle to hold it by; and the face of the linen-cloth must be moistened with a little raw linseed oil (which may either be coloured with alkanet-root, or not,) applied with the finger to the middle of it. The work to be varnished, should be placed opposite to the light, in order that the effect of the polishing may be better seen; and a surface of from one to eight feet square may be varnished at once."

"The rubber must be quickly and lightly rubbed upon the surface of the article to be varnished, and the rubbing continued until the varnish becomes nearly dry: the coil of woolen cloth must be then again

wetted with the varnish, but no more oil need be applied to the surface of the linen cloth, and the rubbing again continue till the varnish becomes nearly dry, as before: and again, a third coat must be applied, in the same manner; then one with a little oil; which must be followed, as before, with two others without oil:—and thus proceed until the varnish has acquired some thickness, which will be after a few repetitions of the series; when a little alcohol may be applied to the inside of the linen-cloth, before wetting the coil with the varnish; and then rub very quickly, lightly, and uniformly, over every part of the varnished surface, which will tend to make it even, and very much conduce to its polish. The linen-cloth must next be wetted with a little alcohol and oil, without varnish; and the varnished surface being rubbed over, with the precautions last mentioned, until it is nearly dry, the effect of the operation will be seen: and, if it be found that it is not complete, the process must be continued, with the introduction of alcohol in its turn, as directed above, until the surface becomes uniformly smooth and beautifully polished."

"*On varnishing hollow and round works.*

"In this case, the woolen-cloth is not to be used with its flat end, *but on its side;* to which the varnish must be applied, as before directed, and be covered with two folds of the linen-cloth, oiled or not, as before mentioned.

"*On varnishing recesses or carved work.*

"When this occurs in cabinet-work, &c., and where the surfaces are not liable to wear, or are difficult to reach with the rubber, a spirit-varnish, made with, or without lac, of the usual gum resins, and considerably thicker than that used in the above process, may be applied to those parts with a brush, or hair-pencil, as is commonly done in other modes of varnishing.

"*On varnishing works in the lathe.*

"This process is exceedingly easy; and does not require much more skill than the mere application of a little oil to the surface of a soft linen-cloth, and putting the lac-spirit-varnish upon it; then both together to be held upon the surface of the work, whilst turned round in the lathe, and rubbed along it, backwards and forwards, till the effect is produced."

The editor has frequently tried the *French polish*, but he has always used a kind of rubber differing from that above mentioned, it is made as follows;—a piece of thick woolen cloth, six or eight inches in diameter, is taken, upon one side of this a few teaspoonsful of the varnish is poured, the edges are then collected together, so as to enclose the varnish in the cloth, and form a handle by which to hold it; this is then covered with a piece of oiled linen cloth, and the rubber is ready for use. When requisite, more varnish may be added; it will be found necessary, occasionally, to pour a little alcohol into the cloth, when the varnish becomes too thick to ooze through.

Some difficulties may be at first experienced in performing this process, but a very little practice will enable any handy person to sur-

mount them, and to produce a beautiful polish without using successive coats of varnish, which require considerable time to dry, and which mode is otherwise attended with much more trouble than the plan here described.

On Bronzing Plaster figures, and other articles. By the Editor.

What is called bronzing, is the giving to articles, an appearance similar to that assumed by statues, and other ornamental works, which are made of the compound of copper and tin, known under the name of bronze. In them the metallic surface becomes corroded by exposure, and in general appears of an intense green colour; whilst the more prominent parts, being most subjected to friction, retain a portion of metallic lustre.

Different modes of producing this effect, are pursued; but they all consist in covering the figure to be bronzed, either with water, or oil paint, of the desired colour, and then rubbing a metallic powder upon the projecting parts.

When water colour is used, the work must be sized over, until it will *bear out*, that is, until the moisture will stand upon the surface, and not sink immediately in. The books in general recommend size made from isinglass, but good, clear, common glue, is much cheaper, and will answer equally well. After the cast, or sculpture has been properly sized, it is ready to receive the colour; this is prepared by grinding Prussian blue, yellow ochre, and lamp black, in some weak size. The colours ought to be ground separately, and afterwards mixed together, as the Prussian blue requires more grinding than either of the others; and because they may afterwards be so mixed, as to produce any tint required. The colour must then be spread evenly over the article to be bronzed, and allowed to dry. When it is dry, dip a brush into some thin oil gold size, scrape the brush, so that but little of the size may remain in it, and pass it over the figure, so as just to moisten every part: it is then to be put by, until it becomes *tackey*, that is, until the finger will adhere to, but not be moistened by the size; it is then ready to receive the bronze powder.

When oil gold size is not at hand, a little japan varnish, or even fat oil, diluted with spirits of turpentine, will answer the purpose.

Sometimes the bronze powder is applied without the intervention of any adhesive matter, excepting the size contained in the water colour. It must then be rubbed on before the colour is perfectly dry.

To Bronze with oil colour.

First give the work a coat of white, or red lead, ground in oil, and when this is perfectly dry, apply another coat, consisting of the colours before named, ground in oil, and mixed with a small quantity of japan varnish, this is to be suffered to dry, until it becomes tackey, when the bronze powder is to be applied to it. This is the mode pursued by Mr. Meer of this city, whose bronzed figures, are beautiful specimens of this process.

On Bronze Powders.

There are various kinds of bronze powder, which are kept for sale by many of the druggists. The *aurum musuvium*, or mosaic gold, is used for inferior articles; this is a preparation of tin, quicksilver, and sulphur, possessing a bright gold-like appearance. A copper coloured bronze, may be obtained by dissolving copper in aqua-fortis, until it is saturated, and then putting into the solution some small pieces of iron, when the copper will be precipitated in the metallic state; the fluid must then be poured off, and the powder carefully washed, dried, and levigated, when it may be put by for use. Bronze powder is sometimes made from Dutch-gold, which is sold in books, at a very low price. This is treated in the same way as gold-leaf, in making the gold powder; all these inferior bronzes require to be covered with a coat of clear varnish, or they will very soon lose their metallic appearance, nor will the varnish entirely prevent, although it will greatly retard this change.

True Gold Powder.

This is prepared by taking gold-leaf, and grinding it with molasses, or honey, on a fine marble slab, or in a wedgwood mortar. It may by this means, be reduced to an extremely fine powder. The whole should then be put into a large glass jar, which must be filled with water, and the mass stirred, until the honey, or molasses is completely dissolved. It is then allowed to remain at rest until the whole of the gold has fallen to the bottom; the larger portion of the fluid may then be poured off, and more water added. This process should be repeated several times, until the water comes off perfectly pure. The powder must then be dried, and it is fit for use. It is particularly requisite to be careful that a large proportionate quantity of water be used in the first washing, otherwise the thickness of the sirop will prevent the fine powder from precipitating.

These processes are given with the double view of satisfying curiosity, and of instructing those who cannot procure the powders ready made; when they can be purchased, it is much cheaper to do this, than it is to make them.

Very excellent gold powder, of different shades of colour, is manufactured by Mr. Henry Carvill of this city.

Mode of applying the Bronze powders.

All the recipes which we have seen, direct the use of a brush, or of a piece of cotton, dipped in the powder; this mode is not only slovenly, but also wasteful, which is of some importance when gold powder is used, and no other material ought ever to be employed, as it greatly excels all its substitutes, both in durability and beauty, and when properly managed, the increased expense is trifling.

The best mode is to cover the finger with a small piece of doe-skin leather; this should be lightly dipped into the powder, and the loose particles rubbed off upon a piece of fine smooth leather, which may be pasted on a small piece of board, and kept for the purpose; or the cover of a book, will answer perfectly well. The powder may then

be applied so as to touch those parts only where it is wanted, and the quantity may be regulated with the greatest exactness. A brush, or a piece of cotton, will allow particles of the powder to fall where it is not desired, and thus injure the work.

We have already said that the prominent parts only, ought to be touched with the powder. Some articles however, admit of more of the metallic covering than others. Thus a medallion, which may be supposed to be frequently handled, and consequently rubbed bright, ought to be covered more freely than a bust, or statue. It is evident that this must be left to the good sense of the workman. Varnish is not only unnecessary, but would materially injure articles, where the genuine gold powder is used.

ENGLISH PATENTS.

Specification of the Patent granted to THOMAS MAGRATH, *of Dublin, for an improved apparatus for conducting, and containing, water and other fluids, and preserving the same from the effects of frost.* Dated January 11, 1825.

To all to whom these presents shall come, &c. &c. *Now know ye*, that in compliance with the said proviso, I, the said Thomas Magrath, do hereby declare that the nature of my said invention, and the manner in which the same is to be performed, are particularly described, and ascertained, in the following description thereof (that is to say:) My improved apparatus for conducting and containing waters and other fluids, and preserving the same from the effects of frost, consists of a double pipe or tube of metal, the one enclosed within the other. The inner pipe or tube is to contain the water or other fluid, and to conduct it; between the two pipes or tubes I introduce charcoal, cork, wool, or any other material that is a bad, or imperfect, conductor of caloric. Under some circumstances I should use three or more pipes or tubes, one within the other, and between each of these pipes I should introduce charcoal, cork, or other imperfect conductor of caloric. Though I have described pipes or tubes one within the other as the mode for constructing my apparatus, yet it is to be understood that I only mention this as a convenient method for making the same, and one I should generally adopt; but the same may be applied in an apparatus of another form,—for instance, when the vessel containing, or conducting, water or other fluid, should be spherical, square, or any other form, I should make such vessel with a jacket or outer case, and fill the space between the two with charcoal, or other imperfect conductor of caloric. Under some circumstances I should dispense with the outer jacket or covering of metal, and adopt one of wood or other convenient material. Having thus described several modes of constructing my apparatus for preventing the freezing of water or other fluids contained therein, I must add, in conclusion, that my said im-

proved apparatus may be varied in several other ways, and that as my invention consists in adapting a coating of any material which is a bad or imperfect conductor of caloric, to the outer surface of vessels of all kinds containing fluids, that every manner in which the same may be adapted to effect the said object, viz. preventing the freezing of fluids contained or passing through the said vessels, I consider to fall within the principles and meaning of my patent right. I therefore claim the same accordingly.

In witness whereof, &c. [*Repertory of Patent Inventions.*

Had Mr. Magrath taken out his patent in the United States, he would have disputed with us our right to surround the pipes of our hydrants with charcoal, wool, tan-bark, straw, "or any other material that is a bad or imperfect conductor of caloric;" and by a slight variation, or extension of his patent, might have ordered us to divest ourselves of our flannel jackets, and every "other material, that is a bad or imperfect conductor of caloric." If Mr. Magrath has extended his patent over England, Scotland, and Ireland, he has paid office fees to the amount of £300 sterling, for what has been known in principle, ever since men began to clothe themselves in the skins of animals; and what has for ages, been freely practised by persons of every grade, from the philosopher, to the old housewife, who has wrapped a piece of woolen-cloth round the water-pipe, or the cock of the cider-barrel, to keep their contents from freezing. [*Editor.*

Patent granted to JOHN STEPHEN LANGTON, *of Langton Juxta Partney, Lincolnshire, Esq. for an improved method of seasoning timber.* Dated August 11, 1825.

In this method of seasoning timber the pieces of it are put into a long vertical air-tight vessel or cylinder, heated externally by steam, or by a water bath, which latter may be either brought to the proper temperature in the common method, or by the use of steam. For either of these methods, the vessel or cylinder which holds the timber, must be enclosed in a second vessel, prepared so as to contain whichever of the two mediums is preferred for communicating the heat. The internal vessel is to rise a little above this enclosing vessel, and is to be closed with a cover, made air-tight, and fastened down in any convenient manner; and in its centre is to be another small lid, in which is to be fixed a mercurial syphon gage: there is also to be "*a screw*" fixed in it, by turning which a communication may be made with the external air, when the timber is to be removed. The top of the external vessel is to be covered with a flagged platform, on which those who are to put in and remove the timber are to stand; and from the part of the internal vessel which rises above this platform, a pipe, furnished with a stop-cock, is to go off sideways to a condensing vessel, below which is to be placed an air-tight vessel, for the reception of the liquor that runs from the condenser, and communicating with it by a tube; from the top of this receiving vessel a pipe ascends to an

air pump, and from its bottom another pipe goes to a water pump, to be used occasionally when the vessel becomes filled with liquor, which is known by a glass tube, fixed to its upper part, which bends round at right angles, and enters into it at its two extremities.

The condensing vessel is composed of a number of vertical tubes, each having at its top, outside, a tunnel, between which and the tube, a narrow interval is to be left for the passage of water, which is to be conveyed by separate pipes to the tunnels, and to be let to trickle down the outsides of the tubes, to keep them cool. The tops of the tubes may be made to communicate with the main pipe, that leads from the timber vessel, either by separate pipes, branching off from them, or by rows of lateral pipes, into each of which a certain number of the vertical tubes are made to open. A similar set of intermediate pipes should be fixed at the bottom of the condenser, to form a communication from the lower ends of the tubes, to the pipe that leads to the receiving vessel.

The vessel or cylinder, that holds the timber, which is thirty feet or more in length, may be made of several lengths of cast iron, furnished with flanches, by which they may be fastened together air-tight with screws and nuts; and when it is to be exposed to steam alone, it should be of that strength as to be able to bear an external pressure of fifteen pounds to the square inch; but when a water bath is to be used, then the bottom of the vessel should be strong enough to bear a force of thirty pounds to the inch, and the top be of the strength before-mentioned, and all the intermediate parts should be proportionably stronger, as they are closer to the lower extremity. The bottom of this vessel should also be fastened down to the external vessel; so that if the latter be filled with water, while the former is empty, it may be prevented from rising from its place.

Small timber should be kept in the vessel twelve hours, exposed to the action of the air pump and the heat, before it is examined; very large timber will require a week to complete its desiccation, and that of intermediate sizes a time, between the two periods, proportionate to its dimensions.

The mercurial syphon gage at the top of the apparatus, will regulate the heat to be applied to the vessel, and also indicate when the operation is perfected. When it shows a depression of three inches of the mercury, the heat of the bath, or surrounding medium, is to be 130° Fahrenheit; when two inches, at a temperature of 120°; and when the mercury is depressed one inch, a heat of 112° is to be applied; but the heat in no case is to exceed 200°.

When it is desired to be known whether the timber is sufficiently exhausted of its juices, the stop-cock of the pipe, that goes to the condenser from the vessel that contains the timber, is to be closed; and if in half an hour afterwards no rise be observed in the mercury, the operation may be concluded to be completed.

The method above described, of extracting the juices from timber, appears to us to be very effectual and practicable; and if, as is generally supposed, the dry rot be principally owing to the sap liquor re-

tained in the wood, this plan may be a means of preventing what we may consider as a national misfortune, from the great destruction it has occasioned in the vessels of the British navy of late years, and the heavy expenses caused by this calamity, at a time when the demands on the public treasury, on other accounts, were so enormous. With a view to this beneficial result, we earnestly recommend trials to be made by the patentee, or by others, of the effect of soaking timber, prepared by his method, in various compositions, particularly those of which oils, fats, or tar form a part.

We think the vertical position which the patentee has chosen for his apparatus, would occasion difficulties in the process which might be easily avoided by placing the principal vessels horizontally.

Except for fir timber, from which some spirits of turpentine might perhaps be extracted in the course of the operations proposed, it appears to us that the condensing refrigerator, and "collecting vessel" or receiver, might be omitted in the apparatus, by which a considerable expense would be saved in its erection, and the whole be made less complicated, without its efficacy being materially diminished.

[*Repertory of Patent Inventions.*

On improved Melting Pots, for Cast-Iron and Brass. By Mr. L. Anstey, *Cast-Iron Founder; with the manner of using them, and a description of his Wind-Furnace.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.

Sir,—I herewith send a melting-pot of my manufacture, which, from several years' experience in the melting of cast-iron, I find to answer the purpose better than any which I have been enabled to procure. They are composed of two parts Stourbridge clay, and one part of the hardest coke, well ground and tempered together. Any further explanation I should be happy to give, if required.

I am, sir, &c. &c. &c.

A. Aikin, *Esq. Secretary, &c. &c.* L. Anstey.

The following particulars were stated by the Candidate, to the Committee.

The composition employed by him is the following:—Take two parts of fine ground raw Stourbridge clay, and one part of the hardest *gas* coke, previously pulverized and sifted through a sieve of one-eighth of an inch mesh. Mix the ingredients together with the proper quantity of water, and tread the mass well (if the coke is ground fine the pots are very apt to crack.) The pot is moulded by hand upon a wooden block, made in the form which its inside is intended to have; this core is fixed upon a pin so that it may be turned round, and a gage to regulate the thickness of the pot, is placed upon a frame made for that purpose. The core is covered with a cap of linen, or cotton, which after being wetted is placed upon it before the clay is put on.

in order to prevent the pot from sticking, when it is to be taken off. When removed the inside is made smooth, a lip formed for pouring out the melted metal, and the pot carefully dried by a gentle heat.

The smaller pots hold about twenty pounds of cast-iron, and can be afforded for ten pence a-piece; the larger ones hold forty pounds, and may be afforded for fourteen pence.

A pot, dried as above, when wanted for use, is first warmed by the fire-side, and is then laid in the furnace with the mouth downwards (the red cokes being previously covered with cold ones, in order to damp the fire;) more coke is then thrown in, till the pot is covered, and it is then brought gradually up to a red heat. The pot is then turned, and fixed in its proper position in the furnace, without being allowed to cool, and is then charged with cold iron, so that the metal, when melted, shall have its surface a little below the mouth of the pot. The iron is melted in about an hour and a half, and no flux or addition of any kind is used. A pot will last for fourteen or even eighteen successive fusions, provided it is not allowed in the intervals to cool; but if it cools it probably cracks. These pots will bear a higher heat than others without softening, and will consequently deliver the iron in a more fluid state than the best Birmingham pots will.

The cavity of the furnace employed by the candidate is eleven inches square in superficial area, and consists in depth of eleven rows of bricks, made of Stourbridge clay; the wind hole is four inches square, and is placed three inches below the top; the bars are either of wrought or cast iron, supported on wrought iron bearers. The ash-hole is ten courses of bricks below the bars, and the chimney is rather a high one. The sides of the furnace wear away by the heat, so that in the first week the cavity becomes two inches wider than at first. It is then brought up to its original width, by a lining of glass-cutters' mud, which consists of fine sand mixed with particles of glass; and this is renewed twice a week. The cavity of the furnace being only eleven inches across, and seven inches of that being occupied by the melting pot, it is of course necessary that the coke used as fuel should be broken into small pieces, not larger than a walnut.

At a subsequent meeting of the committee, D. Campbell, Esq. who had been requested to make some experiments on Mr. Anstey's pots, reported that he had melted a charge of iron in one of the smaller pots, placed in a powerful wind furnace; the pot remained sound.

Into a second pot was put a Wedgewood crucible, inclosing a black-lead one, and that a Cornish one; a cover was luted on, and the pot thus charged was kept for three hours in the same wind-furnace, and was brought unopened to the committee. On examination, Anstey's pot appeared to be quite entire; its shape had not altered, nor was there any change of texture, indicating an approach to fusion; it resisted several blows of a hammer before it broke. Of the crucibles inclosed in the pot, Wedgewood's had cracked to pieces, and the texture had softened considerably, and had undergone a change of shape; the Cornish one was unaltered in shape, and nearly so in texture, having only become somewhat more compact.

A third pot had been exposed for an hour to a very high heat in the

same furnace, being placed on a brick of Stourbridge clay; several small crucibles had been put into it, and a cover had been luted on. On examination, the pot had undergone no change, except that the slag of the coke, which was used as fuel, had glazed it over: beneath the glaze there were no signs of fusion, nor even any change of texture. The brick support was in the state of porcelain jasper; the cover had begun to sink in: the Cornish crucible which was inclosed showed a beginning of fusion; the Chelsea crucible was bubbly, and half melted.

An empty five-inch real Hessian crucible had been heated in the same furnace as strongly as possible: it had not sunk down at all; on being broken the texture appeared porcellaneous, with interspersed air bubbles, showing a beginning of fusion.

A white Birmingham pot was first annealed, and then heated (empty) in the same furnace. On examination by the committee, it was found to be cracked across the bottom, and its texture had become that of porous porcelain jasper.

Another white Birmingham pot was treated in the same manner as the former, and on examination presented several small cracks, and a porcellaneous texture, but less porous than the preceding.

One of Anstey's large pots, in which, five charges of iron had been melted, was shown to the committee; the form was unaltered; it withstood several blows of a hammer before it broke; the texture was granular, without any commencement of porcellaneous appearance.

Additional Observations. By Mr. GILL.

When it is stated in the above account, that Mr. Anstey's chimney "is *rather a high one*," it must not be understood as being a *very lofty* one: indeed it was not higher than the ordinary chimney of a house of three stories; and the upper part of it, for seven or eight feet, was formed of a thick sheet iron cylindrical pipe riveted together.

The internal lining of Stourbridge bricks in his furnace was made to be renewable from time to time, as it became burnt through in use: and with this view it was not united with the external walls of the furnace, but laid in, without any Stourbridge clay or mortar being interposed between the said lining and the furnace walls.

His furnace was, at first, built on the side of his workshop, adjoining to an old rivulet; and in consequence of the *damp air* arising therefrom, he was not able to bring his heats to a sufficient height. He was therefore under the necessity of removing it to the opposite side of the workshop, where, the air being drier, he could obtain the desired result. This is a curious fact, and proves, that although for *moderate heats* a *damp air* is sufficient, and indeed is generally preferred, yet for the *intense heat* required to bring *cast-iron to a proper degree of fluidity* a dry air is requisite.

Mr. Anstey found his melting pots to wear away around their mouths, owing to the oxide of iron falling upon them from the broken pigs of cast-iron with which they were charged, and fluxing them. Had it not been for this misfortune, they would have borne a much greater number of fusions to have been made in them.

Mr. Anstey uses the *gas*-coke as fuel in his furnace, as well as for mixing with the Stourbridge clay, to form his melting pots.

He is in the practice of casting many small articles in cast-iron, and afterwards annealing or decarbonating them, by cementing them at a high red heat for a considerable length of time, say a fortnight or more, surrounded by a mixture of powdered hæmatite, and other ingredients, by which they are rendered tough and malleable, or brought to a state nearly resembling wrought-iron, and at a rate much less than they could be afforded for by forging them; and, indeed, when we consider their *perfect soundness*, arising from *casting them*, over the casualties of forging and *welding wrought-iron*, we conceive that, for many purposes, these decarbonated cast-iron articles, are even preferable to those made of wrought-iron.

On improved Melting-pots for Brass, &c. to withstand the action of Fluxes.

On lately mentioning to an intelligent workman in brass, pinchbeck, gilding metal, &c. and who is also a maker of spelter solders, the melting-pots for cast-iron made by Mr. Anstey, he said they might answer very well for cast-iron, but would not serve by any means for alloys of copper and zinc, nor where fluxes were used, by reason of their *porosity*.

He stated, that he found it necessary to form his own melting-pots of one half new Stourbridge clay, one quarter of broken melting-pots, one eighth of hard coke, and (for the purpose of closing the pores) one eighth part of pipe-clay.

He also, *for the sake of giving them a greater degree of compactness*, adopted the excellent plan recommended by the celebrated Glauber; namely, that of *forming them in metal moulds, strongly compressed by the action of a screw-press.*

He said that provided they were kept continually hot, his melting-pots would serve for a fortnight, and neither zinc, nor fluxes, would make their way through them.

In making his alloys of copper, and zinc, he first melts his copper, covered with a flux of common salt or nitre, and then thrusts the zinc down below the surface of the melted copper, and he thus avoids the loss of the zinc from its oxidation. [*Technical Repository.*

ON ENGRAVING.

(From the Mechanics' Gallery. By C. F. Partington.)

(Continued from p. 69.)

On Machine Ruling, and Engraving in Chalk.

We must here mention, as one of the most signal improvements which has been made in the art of etching since its first discovery, the use of machinery to draw the lines upon the etching ground. All kinds of mathematical and mechanical designs, consist almost entirely

of straight lines and regular curves, the whole of which can be drawn by machinery with a precision that the eye and hand can never equal. Lowry appears to have been the first who used machines in this way, and his performances are truly admirable. Machines for ruling equidistant lines, both straight and waved, are now commonly made in London; they consist of a straight bar of brass or steel, upon which slides a socket, with a steady but easy motion. To the side of the socket is fitted a perpendicular tube, which receives a steel wire, or any other hard substance called the pen. This pen has a point like an etching needle, and it is pressed down by the action of a spring. If then a copper-plate covered with the etching ground, be placed under the ruler, which should be supported at each end and raised about an inch above it, the point of the pen may be caused to reach it; and if the socket to which the pen is attached, be drawn along the bar, it will form a straight line upon the plate, more even, but in other respects the same as if that line had been drawn by hand with a ruler. Now if the plate or the ruler, after a line is drawn, be moved backwards or forwards, in a direction parallel to this first line, any number of lines may be drawn in the same manner, and a design consisting only of straight lines might be entirely completed. In the machines, therefore, a very exact screw, acting upon a box confined by a slide and connected with the bar, or the board upon which the plate rests, produces the requisite motion; and a contrivance or index is used to measure the exact portion of a turn required, before any stroke is drawn. Such is the principle of the machine most generally used; those for drawing curves, are adapted to the wants of particular engravers, and have hitherto been made under their own inspection. One remark, however, applies to them all; the point or pen employed should not be made of steel, which, however well tempered, will require frequent whetting, and must therefore inevitably draw strokes deficient in perfect uniformity. The pen should have a diamond point, which, when once properly figured, remains constantly the same, and imparts an admirable degree of regularity and sweetness to the work.*

Engraving to imitate chalk drawings has lately, very deservedly, merited public attention, by the beauty of many specimens it has produced. It may be considered as a method of etching in dots, since the preparation of the plate, laying the ground, tracing the subject, &c. is the same as in etching. The principal difference is, that instead of lines, as in etching, the drawing, shadows, &c. consist of a mixture of varied, and irregular dots, as freely as can possibly be done, yet carefully, and made more or less soft, so as to resemble the grain produced by the chalk on paper. For every stroke of the chalk may be considered as an infinite number of adjoining points, which are the small eminences of the grain of the paper, touched by the chalk in passing over it. The plate being prepared, and the ground laid, as in etching, the drawing to be imitated may be counterproved on the

* A very perfect machine of this kind will be figured and described in this Journal. It is the invention of Mr. Asa Spencer; and was, in London, preferred to Mr. Lowry's ruling machine.

ground of the plate. If this cannot conveniently be done, black-lead pencil, or red-chalk, must be applied to varnished, or oiled-paper; by which means all the traces of the drawing may be transferred to the ground. The outlines of the drawing must be formed in the etching by points, which will create dots, whose size and distances must be determined by the quality of the strokes of the original drawing. In forming the lights and shades, it is necessary to distinguish between those hatches which serve to express the perspective of the object, and those which form the ground thereof. The principal hatches must be more strongly marked; the middle tints (if etched) marked lightly, or they may be left to be finished by the dry needle, and graver, after the ground is taken off, which will give them a greater degree of softness. In applying the aqua fortis, the artist should be careful not to corrode the lighter parts too much. When these parts are sufficiently bitten, they may be stopped up with the turpentine-varnish and lamp-black; and the aqua fortis may be applied again to bite the stronger parts; and it may be observed, that if the dots which compose the shade, burst into each other, it will not injure the work, except they form too hard a spot, or too considerable a black. When the ground is taken off the plate, it will be necessary to interstipple, with proper points, in the flesh, and softer parts of the work, which will produce a more delicate effect than can ever be attained with the aqua fortis alone. The strongest shade will also require additional strength, and must, therefore, be deepened by slight strokes of the graver. The graver is the only tool that can be depended upon in finishing small subjects which require neatness. The best manner of preparing it is, by changing its situation in the handle so that the belly part of it, which was lowermost, becomes uppermost; then, by turning the handle in the hand, the point acts upon the copper from a greater elevation, which is preferable; as dots only, and not strokes, are required, the tool is managed in this position with much greater ease and freedom. This part of the operation consists only in covering the copper with dots, in a manner, lighter or heavier, proportionate to the colour required. When one covering of dots is scraped off, another must be inserted, and so on; by this repetition a proper grain, and sufficient masses of shade are procured. Though the process is tedious, it requires no very great skill in the artist: care, attention, and practice will enable him to succeed.

This species of engraving admits of greater variety in the mode of executing it, than either etching or engraving with the tool. Of those who profess it, every one has a peculiar method of performing some particular part. In large subjects, and also in those where a general effect only is wanted, and great exactness is not required, some persons use various tools for facilitating their work, such as wheels having single or double rows of teeth at their edges, cradles resembling a mezzotinto grounding-tool (but made with teeth,) and sometimes others constructed according to their own minds: but these tools, though more expeditious than the graver, seldom produce a very good effect, and can never be depended upon, in any degree, for accuracy or neatness. They are, however, much used by the French engravers

in chalks. Indeed this part of the art was first invented in France, and is still performed with good success in that country. Their set of tools for this purpose, amounts in the whole, when perfect, to near 40 articles: and it must be confessed, that the productions of the French engravers very often more nearly resemble original drawings in chalks, than the engraving of the English finished solely with the graver: but, on the other hand, the English productions in this line are universally allowed, by every country in Europe, to possess a certain neatness, accuracy, and mellowness of style, which are sought for in vain in the chalk-engravings of our rival neighbours.

It will sometimes happen, particularly to him who is not well practised in the art, that those parts which were intended to be dark, fail in their proposed effect, which is sometimes the fault of the tool, the ground, or the aqua fortis, but more frequently the inexperience of the artist. When this is the case, the plate may be re-bitten by heating it, and, at a convenient part thereof, melting a quantity of ground, and, with a dabber, carefully, by degrees, transplanting it, by beating it gently to the parts proposed, so that the surface only of the copper may be covered, and the hollows or excavations of the work may be free and clean. When the plate is cold it may be re-bitten with aqua fortis as before. It is adviseable not to smoke it in this operation, lest the heat of the candle, or lamp, melt the ground into the work. This method of re-biting the work is used not only in engraving in chalks, but in every species of engraving in which aqua fortis is used, and in every kind of etching, and is among the secrets of the superior engravers.

To clean engraved strokes, they should be washed with a little spirit of turpentine; if the dirt is of long standing, soap-lees poured on the plate while it is heating will be very effectual in clearing away the dirt. But it must be immediately washed off with plenty of cold water, otherwise it will injure the work; it is also too strong for mezzotinto plates, unless used very carefully, and not suffered to continue long on the plate.

The chief merit of engraving in chalks is to form a kind of deception, which, when well executed, it does very successfully, so that the connoisseur is hardly able, on the first inspection, to distinguish between the original drawing and the engraving made in imitation of it. It is extremely useful, as it serves to multiply copies of drawings left by those masters who excelled in the use of chalks, and furnishes young artists with the same assistance in the practice of drawing as if they had access to the original. Drawing also made with chalks of different colours may be imitated in this manner, if a plate be provided for every colour. The French have very well imitated drawings on blue paper, by using two plates, one of which printed the black chalk effect, the other that of the white chalk. Chalk-plates, likewise, printed in black, on blue paper, may afterwards be touched with white chalk, whereby they will have a very pleasing effect.

(TO BE CONTINUED.)

On obtaining Early Crops of Peas. By THOMAS ANDREW KNIGHT, *Esq. F. R. S. President of the London Horticultural Society.*

Considering even trivial improvements to be important, relative to the management of those species of plants, upon the culture of which much labour and capital are annually expended, for private use and for the supply of the public markets, I address to the Horticultural Society, the following *account of a mode of obtaining an early crop of peas*, which I have practised with great success in the present spring.

When severe winters have proved fatal to crops of peas sowed in the preceding autumn, many gardeners have experienced the advantages of raising other plants in pots, with artificial heat, early in the spring, and subsequently transplanting them into the common soil; and the object of the present communication is only to describe an improvement in the mode of repeating this operation.

In the present spring, my garden, owing to its soil being cold, and the climate rather inhospitable, did not contain, in the end of February, a single living pea-plant: and I purposely delayed the experiment, which I proceed to relate, till the first day of March. Upon that day the ground was prepared, and part of the seed sown, as usual, in rows, where the plants were to remain; at the same time other peas, of the same early kind, were sown in circles within the circumference of pots of ten inches in diameter, inside measure. These pots were nearly filled with a compost of a peculiar kind, from the highly nutritive and stimulating qualities of which I anticipated much acceleration in the growth of my plants, with the advantages of being able to remove them, at the proper period, to the open ground, without having their roots at all detached from their pasture, owing to the fibrous organic texture of the compost. This was made of equal parts of thin turf, to which much lifeless herbage was attached, and unfermented horse-dung, without litter; and a quantity of the ashes of burnt weeds, containing, as usual, a good deal of burnt mould, equivalent in bulk to about one-twelfth of the other materials. Equal parts of fresh soil, with unfermented horse-dung, with litter, and a small quantity of quick-lime, or wood-ashes, would probably operate as powerfully as the compost above described. The whole was reduced to small fragments, and well-intermixed; and the pots were filled with it within an inch of their tops. The peas were then sown upon the surface of the compost, and covered with common mould; and the pots were placed in my peach-house. In this they remained till the plants were an inch high, when they were removed into the open air; but they were protected during the night, for some time, and particularly when the character of the evening indicated the probability of frost.

In the last week of March the plants were taken from the pots, and planted in rows in the open ground; and I have the satisfaction to observe, that very nearly the whole of the compost adhered firmly to their roots; and that their growth subsequently was not apparently checked, in any degree, by their transplantation. They were placed

in rows contiguous to those which had been previously sown, a small quantity of compost, similar to that put into the pots, being added; and the common mould was then closed round their roots, and raised upon each side of the rows. Sticks to support and protect the plants were immediately added, in rather more than the ordinary number and quantity; and subsequently no particular care, or attention, was paid to them.

On the morning of the 29th of April, I ascertained the comparative growth of my plants, which had been subjected to the different modes of treatment above mentioned, in two rows which grew contiguous to each other; when I found the height of those which had been raised in pots to be fifteen inches, and that of the others to be scarcely four inches; and I much doubt whether I ever possessed, in the most favourable season, as forward a crop of peas as my garden now contains.

Many causes appear to me to have operated in conjunction to produce the foregoing effects. It has long been known that snow does not, in winter, lie so long upon ground, which has been manured in the same season with fresh unfermented horse dung, as upon unmanured ground; and therefore I conclude that some degree of heat existed in, and emanated from, the compost, though probably never in a sufficient degree to have been sensible to the touch of any warm-blooded animal. If placed in a considerable heap, such a compost as that described, and even when the horse dung is much less in quantity, will heat violently. I have often suffered the compost of this kind, which I employ for pine apples, to become hot to prevent the subsequent appearance of earth-worms in it.

If heat was in any degree generated by the compost in which the peas grew, the escape of it was necessarily retarded by the numerous sticks by which the ground was partially covered; and little injury could have been sustained from the shade of those, because the quantity of light, comparatively with the temperature of the air, and growth of the plants, is very great after the vernal equinox; and it is every day increasing in power and influence.

Another cause of the rapid growth of the transplanted peas, has probably been the very favourable state of the soil in which they have been placed, it having been turned over with the spade immediately before transplantation took place; for peas never thrive well in strong soils, when such have been compressed and soddened, in early spring, by much moisture. But the chief causes of their very rapid growth, have, I believe, been the highly nutritive and stimulating quality of the compost, and the presence of some degree of additional warmth. For I have in former seasons derived great advantage from placing a moderate quantity of nearly similar compost immediately under rows of peas, which have been sown in the usual manner; except that the seeds were placed upon the surface of the soil, within which the compost had been buried, and covered by having had the soil collected from each side to form a ridge over them. In all cases where a compost of the kind I have described is employed to accelerate the growth of dwarfish and early peas, it should be used in small quanti-

ties only; that the early growth of the plants may be promoted, without excessive, and consequently injurious, luxuriance being given. For transplanted peas, I should prefer a poor and light soil; so that the roots might be led, as they would be under such circumstances, to confine themselves to narrow limits: and the plants consequently be brought to an early maturity.

Note by the Secretary.

In a letter received from Mr. Knight, dated the 27th of June, he mentions that he had then seen the full result of his experiment on the mode of raising early peas, above described. The plants so treated had produced a very abundant crop at least twelve days earlier than those sown at the same time in the usual way, and with a much more rapid succession of produce.

On the Mineral History of Gold, and the separation of it from Earthy and Stony Bodies, by Water, Mercury, &c. By the late WILLIAM LEWIS, M. D.

(Continued from p. 81.)

There are sundry European rivers which roll particles of gold with their sands in no great quantity, yet such, that the neigbouring inhabitants, at certain seasons, find their account in collecting them. M. de Reaumur, in an essay in the French Memoirs for 1718, drawn up from materials furnished by the intendants of the several provinces, in pursuance of the orders of the Duke of Orleans, gives an account of ten rivers or rivulets in the territories of France, that have gold mixed with their sands in certain parts of their course: the Rhine, from Brisac down to Strasburg, sparingly; from thence to Philipsburg, more abundantly; and most of all so between Fort Louis and Germesheim. The Rhone, in the Pais de Gex, from the conflux of the Arve, from which it is supposed to receive its gold, to about five leagues lower down: the rivulets of Ferriet and Benagues, which rise from the heights on the left hand of the descent from Varilhere to Palmiers: the Ariege, *aurigera*, about Palmiers, below where it receives the two foregoing rivulets: the Garonne, some leagues from Toulouse, below where it receives the Ariege: the Salat, which rises, as the Ariege, in the Pyrennees: the Ceze and Gardon, which come from the Cevennes, and the Doux, in the Franche-Compte. The last of these rivers is the poorest, the gold having hitherto been collected from it rather in the way of curiosity than with a lucrative view: the greatest quantities are obtained from the Rhine, not that this is really the richest, but on account of its sands being the most industriously searched; for some of the others, particularly the Ceze and Gardon, appear to be at least equal to it in richness. The quantity got from the Rhine, in an account of near two leagues below Strasburg, is said to amount to no more than four or five ounces in a year: this is the quantity brought to the magistrates of Strasburg, who farm out the right of col-

lecting it, on condition of its being sold to them, at a price considerably under its value; so that it may be presumed that a part is otherwise disposed of, and that the quantity really obtained, is considerably greater.

There are many other rivers reported to yield gold; as the Tagus, the Danube, the Elbe, the Oder, the Inn, the Sala, &c. The Schwartz, in the county of Schwartzburg, in Upper Saxony, is said to be rich in this metal, and its sands to be worked with great profit: Stahl mentions a piece found in it, as broad as a middling bean, though not so thick, and supposes that the Sala receives all its gold from this river; the gold of the Sala being found only below where the Schwartz enters it, and being less plentiful, and in smaller grains. It is generally reckoned that the gold particles, in all auriferous rivers, are washed out by the stream from such rich beds, and afterwards rest or settle where the current is languid, or in places where they escape its force: from what particular sources the gold in different rivers proceeds, does not seem to have been examined.

The richest parts of rivers, within the extent in which they roll gold, are those where their course is slow and uninterrupted, where they widen or change their direction: the most favourable season is when the water has subsided after a flood. The appearance of the sand affords a useful mark of distinguishing the richest spots; the gold being always most plentiful where the sand is reddish or blackish, or of a colour somewhat different from what it is seen elsewhere; not that the red or black sands have any natural connexion with the gold, but on account of their being more ponderous than the white; so that the same cause which determines the particles of gold, determines these also, to subside. The black sand abounds with iron, being vigorously attracted by the magnet; the red, viewed in a microscope, appears, as Reaumur observes, a beautiful congeries of coloured crystals, imitating all the gems known to the jeweller, among which, those of the ruby and hyacinth tints are the most common; whence the reddish colour of the sand to the naked eye: the particles of gold are of irregular figures, but constantly flat, smooth, and with the edges rounded off.

Some gold has been discovered in Britain at different times, though, hitherto, in little quantity. Instances are mentioned in Houghton's Collections, from Camden, Sibbald, and Gerard de Malines, of gold found in Scotland, about the head of the Clyde, in Crawford-moor; and Boyle says, he had from some part of Scotland, divers large grains of gold, taken up near the surface of the earth, over a lead mine; one of which, clear from spar, weighed two hundred and one grains. Mr. Boyle had also an English tin ore, wherein there lay, in little cells, a number of small leaves or chips of gold: he observes, that, though the tinmen, unable to separate them to profit, usually melted both metals together, yet he was assured, that one person advantageously employed his children to pick out the gold from the ore, skilfully broken. Some earlier writers also mention gold found in the tin ores of Cornwall; and about the beginning of the present century (1700) a patent is said to have been obtained "for separating gold and silver

from tin, by precipitation in a reverberatory furnace, with some peculiar fluxes:" what success this scheme met with, I have not learnt. Mr. Borlase, in his natural history of Cornwall, gives an account of some tin ore, abounding with a yellow matter, which was taken by the workmen for mundic: some bits of the yellow matter, one of which was a vein, as large as a goose quill, included in a stone, the size of a walnut, produced on being melted an ounce of pure gold: he mentions several other pieces of considerable bulk, and gives a figure of one found in 1756, weighing three hundred and seventy-six grains. It is supposed to be chiefly the stream tin, (that is, the tin ore found in detached pieces on the sides of hills,) which contains gold; that all of this sort contains more or less of it; and that both the gold and tin ore have been brought from elsewhere by torrents of water, and deposited where they are now found, like the gold sands of rivers.

Boyle conjectures that, besides the grains of gold which lie detached among sands, there may be many particles so minute, and closely fixed to the sand, as not to be perceivable by the eye, or separable by the common methods of washing or picking; that many small portions of the metal may be incorporated also with the body of the sand, and that by skilful management they might be extracted. Experiments, he says, confirmed him in this persuasion: later experiments have verified it, and shown the existence of gold in sands, to be even more extensive than he seems to have apprehended. Many of the common sands, particularly the yellow, red, black, and those of a black colour inclining to violet, appear to be rich in gold: Becher and Cramer presume that there is no sand in nature entirely free from it. Hellot relates, that in eleven assays of one kind of sand, made by M. Lieberecht, by a process described in the sequel, the yield of noble metal turned out constantly from 840 to 844 grains on the quintal, or 921, 600 grains, exclusive of what remained in the scoriæ, which were still found to be rich; that different parcels of sand, taken up at no great distance from one another, differed in degree of richness, some having afforded above 1000 grains, others only 350, and others yielding none by the treatment which had succeeded so well for the rest; and that of the metal thus obtained from sands, two-thirds are commonly gold, and the rest silver. Yet, notwithstanding the great richness of these sands, no means have hitherto been discovered of availing ourselves of the metal they contain, or of extracting it to advantage in the large way. Becher, indeed, undertook to obtain gold with profit from the common sea sands, and entered into engagements with the states of Holland, for establishing a mineral work on this foundation; but though experiments made on little quantities, promised very considerable gain, and though on trial in the large, is likewise said to have proved successful, yet, as he communicated the whole process to the commissioners appointed to examine the affair, and, as he has shown, that such a work might be carried on more advantageously in Holland than in other parts of Europe, its never having been prosecuted in Holland, affords a strong presumption of its not being sufficiently lucrative. The existence of gold in sands, is, nevertheless, an interesting

fact, at least to the philosopher; and further examination may, perhaps, find means of making it turn to account.

Though gold has been but lately discovered, or expected in these minerals, in which it is so common and so plentiful, their unpromising appearance having given little encouragement to examine them, there are others, whose flattering colour has raised great expectations, but which have not been found, upon experiment, to yield any gold. The yellow pyritæ, or marcasites, and other minerals of a golden colour, or containing gold-coloured specks, have, by some, been regarded as ores or matrices of gold, and accordingly submitted to operations as fruitless as expensive: their losing their colour in the fire, or changing it to a yellow, soon discovers that their tinging matter is not gold, but sulphur, or a ferruginous calx. There are, indeed, pyritæ which contain gold, and in quantity sufficient to deserve notice. Henckel, in the 12th chapter of his *pyritologia*, gives an account of some assays of minerals of this kind, brought from the Hungarian mines, one of which yielded on the centner, or 1600 ounces, half an ounce of noble metal, of which one-fifth was gold, and the rest silver: from the same quantity of another, he obtained no less than sixty ounces of silver, and eight ounces and a half of gold: but the gold, as he observes, is by no means proper to the pyrites, or an essential part of its composition, having been only casually intermixed, as it is in stones and other minerals, in the gold mines.

Many have been deceived also, by some of the talcs: of which there is one species, naturally of a gray colour, which in a moderately strong fire, changes to a gold yellow; and another, naturally of a glittering gold colour, which receives no change from moderate fire: both these bodies have a further resemblance to gold, in imparting a deep yellow tincture to strong *aqua-regia*. By repeated digestion in fresh *aqua-regis* all the colouring matter may be extracted, and the earthy part left white; but the solution yields no gold, and is found to be no other than a solution of iron. Reaumur observes, that spangles of the yellow talc are frequent in the sands of some rivers, and that they may readily be distinguished from gold, which they have often been taken for, by viewing them with a magnifying glass; the gold particles found in rivers being constantly smooth, with the edges rounded, while the talky ones, are rugged and sharp-edged.

[TO BE CONTINUED.]

FROM THE GLASGOW MECHANICS' MAGAZINE.

ESSAYS ON BLEACHING.

By JAMES RENNIE, A. M. Lecturer on Philosophy, &c. &c. London.

No. I.

History of the Art.

SECTION I.

Bleaching may be defined, the art of whitening cloth, and other articles of manufacture, by depriving them of such colouring materials

as shall naturally or accidentally adhere to them. The slightest acquaintance with the operations and instruments of this art, will be sufficient to show that it has little dependence on mechanical principles, and that it is almost wholly to be referred to those of chemistry. In an inquiry, therefore, into the improvements which have been made in bleaching, it will be necessary to bear this in mind in explaining the modes of operation, and accounting for the changes produced by the agents which are employed. From this view of the subject it will be evident, that it opens an extensive field for scientific discussion and research, in which the general scholar may receive much interesting knowledge, and the manufacturer, important and indispensable information. The Essay will be most naturally and conveniently arranged, by treating, first, of the history of the art; then, considering the apparatus, the agents, the substances to be operated upon, and the processes, in their order; and lastly, by examining the theories of the art which have been proposed.

Our knowledge of the arts exercised in the earlier ages of the world, must always be scanty and imperfect, as the records which contain the narrative of wars, revolutions, and the extraordinary phenomena of nature, are employed with matters of too high import, to descend to delineations of the peaceful arts exercised in the calm of domestic privacy. In the infancy of letters also, men of genius were either poets, historians or lawgivers, and none thought the arts of sufficient interest to engage their attention. All our information, therefore, of the arts of antiquity, must be derived from the writings of those three classes of authors, and must consist chiefly of incidental circumstances, and allusions which they may happen to mention.

The earliest writings which have been preserved, contain such circumstances and allusions as leave no doubt that the manufacture of cloth was understood in the time of their authors. In Job, which is considered to be the most ancient book now extant, there is a very striking illustration of the transitory nature of human life, taken from this art, and the very allusion indicates that it was practised with much expedition: "My days," says he, "are swifter than a weaver's shuttle." So early also as the time of Abraham, some kind of tape or inkle seems to have been made, if the passage, "I will not take a thread even from a shoe-latchet," is properly rendered. That the manufacture of cloth in the East was in a considerable state of advancement at an early period, appears also from the circumstance that veils were worn by the women as at present. For example, Abimelech says to Sarah that Abraham was to her a "covering of the eyes:" Rebekah also covered herself with "a veil" when she first saw Isaac. "Fine linen" is mentioned in the book of Genesis as a part of the courtly ornaments which Pharaoh bestowed upon Joseph; and, it may be inferred from this, that the Egyptians used flax, in preference to cotton, or any other material, as an article of dress. Wool was prohibited on account, as Ezekiel says, "of its causing sweat," and not only so, but the Egyptians held "every *shepherd* in abomination." (Gen. xlvi. 34.) A mixture also of woolen and linen, was forbid by the Mosaic law, (Deut. xxii. 11.) and probably for the same reason.

We find also that "fine twined linen" is very frequently mentioned by Moses in the decorations of the tabernacle, and commanded for the vestments of the Levites. Ezekiel mentions "linen bonnets for the head, and linen breeches for the loins." But we are not entirely left to conjecture, concerning the "fine linen of Egypt," as we possess specimens of it, which, although injured by time, are still sufficiently preserved to show its texture; I refer to that which enwraps the Egyptian mummies, and of which specimens may be seen in the Hunterian Museum. In an account of a mummy, in vol. 54 of the Philosophical Transactions, Dr. Hadley says, that when the outward painted covering was removed, nothing was to be seen but linen fillets which enclosed the whole mummy, the uppermost of which were of a degree of fineness equal to what is sold in the shops under the name of long lawn, and the weaving seemed to have been executed in the manner of Russian sheeting. This mummy was taken from the catacombs of Cairo. The mummy of an Ibis in the London Museum, which I examined with some attention, was wrapped in linen of a dark brown colour, and of a very open fabric, similar to what we denominate gauze. The threads were very even and uniform, and the distance between them seemed to be mathematically exact; so far as I could judge, it seemed to have been wrought in what our mechanics would call a 600 reed, that is, 600 threads of warp to the yard. This sufficiently shows that the Egyptians were considerably advanced in the art of making linen at a very early period, as the chronology of the mummies is by all accounts of great antiquity. The invention itself is ascribed to one of their kings. (Clem. Alex. Strom. I. 225.) We know farther, that the manufacture must have been extensive, as it was made an article of export, and the crops of flax which yielded, according to Pliny, (xix. 1.) four sorts of linen, are mentioned in conjunction with those of barley, in the account given by Moses of the plagues of Egypt.

But although we find many notices both in the Jewish and Heathen antiquities, of the manufacture of linen cloth, there are extremely few of any of the processes used for finishing it by washing or bleaching. In the time of Job, the different qualities of water, as to its power of cleansing, seem to have been known, if we do not consider the passage, "though I wash myself with snow-water," to have merely an emblematical reference to the whiteness of snow, rather than to the properties of the water. The prophet Malachi uses a figure, however, which leads us to believe that some method of whitening cloth was used in his time. He compares the scrutiny which Jehovah makes into the affairs of men, to "the refiner's fire and *fuller's soap*." Borith and the best commentators are of opinion that this "soap" was the natron at present used for the purposes of bleaching, in several countries in the East: of which Dr. F. Buchanan gives some account in the first volume of his journey to Madras. In the Apocalypse, "fine linen, clean and *white*," is made an emblem of righteousness and purity, and in the same book, "white raiment" is mentioned in conjunction with "gold tried in the fire," intimating that it had undergone some analogous process of purification.

Before the Apocalypse was written, however, we know that bleaching was practised by the Romans, and in all probability they would derive it from some of the nations more advanced in refinement than themselves. This conjecture is rendered the more probable, that the use of linen was regarded by many of the Romans as an unpardonable luxury, and those who piqued themselves upon preserving the ancient severity and simplicity of manners, boasted that they had never degraded themselves by such effeminate apparel. Indeed it is not unlikely that in this, as in most other arts, they had the Greeks for their masters, who, we know, had some method of bleaching by means of lime. This we learn from Theophrastus, who wrote 300 years before Christ. He relates that a ship loaded with linen and *lime for bleaching it*, was destroyed by the accidental access of water to the lime. It may be inferred from this, that they used the lime in a caustic state, and not as a simple earth, as this cargo must have consisted of burnt limestone, for the water to have rendered it capable of destroying the vessel.

But however ignorant we may be of the processes followed by the nations of antiquity for whitening their linen and cotton garments, we are sure that they did employ some efficient mode. For the wrappings of the mummy in the Hunterian Museum, injured as they must be by time, are much whiter than any unbleached linen with which we are acquainted. The fairest specimens are of the colour which Werner would call yellowish or brownish white—our whitest linens he would denominate grayish or bluish white. Most probably the Egyptians employed natron for the purpose of bleaching. "It would soon be observed, indeed, that the action of water, together with that of the sun and air, rendered cloth whiter than such as had been recently manufactured; and since the first step towards refinement is to add beauty to utility, as the state of Society improved, a desire to produce cloth of a pure and spotless white would naturally arise." Such simple modes of whitening cloth as would thus naturally be discovered, are alluded to by Job, (ix. 30,) who speaks of washing with Bor, rendered by Junius, *in loco*, *smegmate*, and supposed, by Goguet, (I. 132,) to be *saltwort;* and by Homer, the most ancient heathen author now extant, in the Sixth Odyssey, where Ulysses finds Nausicaa with her maidens employed in washing their garments, and bleaching them in the sun. We learn from Herodotus also, that the Babylonians wore tunics of *lawn* which descended to their feet, and that the art of bleaching these, and of staining them with different colours, was similar to that still practised in India. (See lib. I. N. 195, and Goguet III. p. 187.)

(TO BE CONTINUED.)

On the Nature and Properties of Timber, Extracted from "The Elementary principles of Carpentry, by THOMAS TREDGOLD."

(Continued from page 74.)

Laws of Seasoning.

The time that is required to season, or to dry a piece of timber, obviously depends upon its magnitude; for we have seen that in a

small piece, it will become perfectly dry in a few days: therefore some rule in this respect is desirable. A complete solution of the problem cannot be effected without more accurate experiments had been made on pieces under various circumstances. But till something better shall be done, the following investigation may be useful.

The time required to dry a piece of timber, will depend on the quantity of surface exposed to the action of the air; and while the quantity of timber remains the same, the larger the surface, the sooner it will be dry.

Also, if the quantity of surface remain the same, the time of drying will be proportional to the quantity of matter; as the greater the quantity of matter under the same surface, the longer it will be in drying.

Let l be the length of a tree, which may be supposed to be a cylinder, and d its diameter, and $p=3{\cdot}1416$.

Then, by the principles of mensuration, the surface of the cylinder is equal to $pdl+\frac{1}{2}pd^2$; and its solid content is $\frac{1}{4}pd^2l$. But the time of drying will vary in the inverse ratio of the surface, and directly as the solid content: call this time T. Then $\frac{\frac{1}{4}pd^2l}{pdl+\frac{1}{2}pd^2}$: T, or $\frac{dl}{l+\frac{1}{2}d}$: T. And, if c be a constant quantity, to be found from experiments, we have $\frac{cdl}{l+\frac{1}{2}d}=T$, when the beam is cylindrical.

And in a rectangular beam $\frac{cbdl}{lb+ld+bd}=T$; where b is the breadth and d depth of the beam. When a table of reciprocals is at hand, the latter rule becomes much more convenient for calculation under the form $\frac{c}{\frac{1}{d}+\frac{1}{b}+\frac{1}{l}}=T$.

This investigation is made on the supposition that the evaporation is free and equal at every part of the surface; but this is not the case in seasoning, as the evaporation from the ends is greater than from the sides, and greater from the upper side, than from the under one; but it is perhaps sufficiently correct to be useful, at least till something better shall be done.

Equal drying would be much promoted by often turning the pieces, and by keeping them free from the ground or other damp bodies; and the more equal the drying is, the more nearly these rules will apply.

Timber is used in two states, that is, when it is *dry*, and when it is only *seasoned*. The term, seasoned, however, is not very accurately defined. Rondelet considers timber to be sufficiently seasoned for carpenters' work when it has lost about one-sixth of its weight. But according to my own observations, timber has undergone what is termed a proper seasoning, when it has lost about one-fifth of its weight; therefore, I shall call that timber *seasoned*, which has lost one-fifth of the weight it had at the time of felling.

It also appears from the experiments of Duhamel and Couch, that

timber loses about one-third of its weight in becoming dry; and such a degree of dryness being sufficient for the joiner's purpose, I shall consider timber *dry*, when it has lost one-third of its weight.

Thus the terms *dry* and *seasoned* will have a more certain meaning; and when drying is carried to its greatest degree, the timber may be called *perfectly dry*, to distinguish it from that degree of dryness which renders it fit for joiners' work.

In order to compare the times required to season, and to dry timber, when the sizes of the pieces remain the same, it will be necessary to consider the progress of evaporation from the same quantity of surface.

Let the whole time be conceived to be divided into equal parts, then the quantity evaporated during any one of these parts of the time, will be inversely as the square of the time, between that part and the commencement. For as the time increases, the quantity of moisture decreases; and the force of evaporation being proportional to the excess of moisture, the quantity evaporated must decrease in the inverse ratio of the time; but if the evaporating force were constant, the quantity evaporated must be less and less at each successive space of time, from the decrease of moisture; therefore, as both the evaporating force, and the quantity to be evaporated, decrease with the time, the quantity evaporated during any space or part of the time, is inversely as the square of its distance from the commencement.

Now, according to this law, the whole quantity evaporated during any time, counting from the beginning of the process, will be inversely as the cube of that time: therefore, denoting the time necessary to season a piece of timber by unity, or 1, we may find the time required to dry the same piece. For $\frac{1}{5} : \frac{1}{3} :: \frac{1}{1^3} : \frac{1}{\text{cube of time of drying}} =$ $\left(\frac{5}{3}\right)^3 = 4{\cdot}63$ nearly: that is, it requires 4·63 times as long to dry a piece of timber, as it does to season it, if the piece remain of the same size.

Hence it appears how slowly the process of drying goes on; and the preceding equations showing that it proceeds most rapidly in small pieces, the importance of reducing timber to its proper scantlings for use, is obvious. For, however dry a piece of timber may be, when it is cut to a smaller scantling it will still shrink and lose weight, being always less dry in the centre than at the surface; and the more rapidly the drying has been carried on, the greater will be the difference. Nevertheless, in the first stages of seasoning, it is best that it should proceed slowly; otherwise the external pores shrink so close as not to permit the free evaporation of the internal moisture, and the piece would split from unequal shrinking; and, lastly, it should be reduced nearly to the proper scantling some time before it be framed.

The long time which large pieces require to season, should render their use less frequent, without a proper time can be allowed. In

the following table, I have given the times of drying and seasoning pieces of different sizes, calculated by the rules laid down in this article, which may be useful, as it shows at once the time necessary to bring different scantlings to the same degree of dryness.

Length in feet.	Breadth in inches.	Thickness in inches.	Time of seasoning in months.	Time of drying in months.
10	6	6	6¼	29
10	8	8	8½	39
12	10	10	10	48
12	12	12	12	57
12	14	14	14	66
12	16	16	17	76
18	18	18	19	86
20	20	20	21	96

Of the decay of Timber.

Timber, when properly seasoned, is strong, tough, and elastic; but it does not long retain those properties, in any state or situation. Timber is generally employed in situations where it is continually dry, where it is constantly wet, where it is alternately wet and dry, or where it is exposed to heat and continued moisture. The effect of each of these states is the next object of attention.

Effect of continued Dryness.

Timber that is constantly dry, or affected only by the small quantity of moisture which it absorbs from the air in damp weather, has been known to last for seven or eight hundred years; but, even in this state, time produces a sensible alteration in its properties; for it is found to lose its elastic and coherent powers, gradually, and to become brittle. Hence it is unfit to sustain the action of variable loads, though in a state of rest, it may endure an immense length of time.

Effect of continued Wetness.

The wood of trees in its natural state, is a very compound substance; a certain portion of its constituents is soluble in water, another part may be extracted by alcohol, and the part remaining, after being treated with alcohol, is the pure woody fibre, or lignin, of chemists. After water has extracted all that is soluble by it, from timber, it is obvious that while the timber continues immersed in water it may remain unchanged for an indefinite period; but if it be taken out and dried, it is found to be brittle and effete; or, to use the workman's expression, "its nature is gone;" and, as Dr. Sloane has observed of oak that had been buried in a wet situation, "it dries, splits, becomes light, and soon impairs." But though oak timber taken from bogs is always found to be brittle and in a state of decay, fir, from the same bog is often, if not always, in a much sounder state.

Effect of alternate Dryness and Moisture.

When timber is exposed to the action of alternate dryness and moisture, it soon decays. It has been already noticed, that repeated steeping and drying removes a sensible portion of the wood at each operation; and it is evident, that at each drying a new portion of solu-

ble matter is formed, which either did not before exist, or which is rendered soluble by a change in its principles. This conclusion is further established by Saussure, who found that wood, the most completely freed of its soluble principles, furnishes always by maceration in water, with the contact of air, infusions holding extractive matter dissolved. The effect of this kind of decay may be observed in weather-boarding, fencing, and in any situation where wood is constantly exposed to the vicissitudes of the weather. When the timber has been thoroughly seasoned, painting or any kind of coating that is capable of resisting moisture is the best means of preserving it from this kind of decay.

(TO BE CONTINUED.)

NATURAL HISTORY.

The following article is extracted from Dr. Godman's "AMERICAN NATURAL HISTORY;" the first volume of which, is about to be published, by Messrs. Carey & Lea, of this city. To do full justice to the author's general manner of treating his subject, we have inserted at full length, his account of the *Grizzly Bear:* from this it will be seen, that the work is not intended for the use of the technical naturalist, alone; but that its object is also to give that information respecting the animals of our country, which is most interesting and acceptable to the general reader. We shall hereafter make other selections from the same source, as in so doing, we feel assured that we shall communicate both pleasure and information.*

THE GRIZZLY BEAR.

Ursus Horribilis.—ORD.

Ursus Horribilis; SAY. Long's Exped. to the Rocky Mountains. vol. ii.
Ursus Cinereus; DESM. Mam. p. 164.
Ursus Ferox; The Grizzly, White, Variegated, and Brown Bear of LEWIS and CLARK.

This bear, justly considered as the most dreadful and dangerous of North American quadrupeds, is the despotic and sanguinary monarch of the wilds over which he ranges. Gigantic in size, and terrific in aspect, he unites to a ferociously blood-thirsty disposition, a surpassing strength of limb, which gives him undisputed supremacy over every other quadruped tenant of the wilderness, and causes man himself to tremble at his approach, though possessed of defensive weapons unknown to any but the human race. To the Indians, the very name of the grizzly bear is dreadful, and the killing of one is esteemed equal to a great victory:—the white hunters are almost always willing to

* The above work will consist of 3 vols. 8vo. of about 400 pages each. It will be illustrated with a considerable number of plates; the first volume contains fifteen; those which we have seen, are executed in a very good style, and the paper and typography, are excellent. The second volume, we understand, is nearly finished; and the materials for the third, are arranged. The price of the whole, will be ten dollars.

avoid an encounter with so powerful an adversary, and seldom, or never, wantonly provoke his anger.

This formidable bear, unhesitatingly pursues and attacks men or animals, when excited by hunger or passion, and slaughters indiscriminately, every creature whose speed or artifice is not sufficient to place him beyond his reach. The bison, whose size and imposing appearance, might seem to be a sufficient protection, does not always elude his grasp, as the grizzly bear is strong enough to overpower this animal, and drag its carcass to a convenient place to be deposited and devoured at leisure.

However singular it may appear, that an animal endowed with such a fondness for destruction and blood, can exist altogether on vegetable food, it is a fact that the grizzly bear, no less than all other species belonging to the same genus, is capable of subsisting exclusively on roots and fruits; this may be inferred from the peculiarities of their system of dentition. It is by no means surprising, that hunters and travellers should suppose the grizzly bear to be almost wholly carnivorous, seeing that he displays such an unappeasable ferocity of disposition, and so uniform an eagerness to destroy the life of any animal that falls within his power.

This bear, at present inhabits the country adjacent to the eastern side of the Rocky Mountains, where it frequents the plains, or resides in the copses of wood, which skirt along the margin of water courses. There is some reason to believe that the grizzly bear once inhabited the Atlantic regions of the United States, if we may be allowed to form any inference from traditions existing among the Delaware Indians, relative to the big naked bear which formerly existed on the banks of the Hudson. The venerable Heckewelder informs us, that Indian mothers used to frighten their children into quietness, by speaking to them of this animal.

Notwithstanding it was mentioned a long time since by La Hontan and other writers, it has been but recently established as a distinct species in the works of systematic zoologists. Say, was the first to give a full description of it, in the well known work we have quoted at the head of this article.

Two cubs of the grizzly bear were some time since kept alive in the menagerie of Peale's (now the Philadelphia) Museum. When first received they were quite small, but speedily gave indications of that ferocity for which this species is so remarkable. As they increased in size, they became exceedingly dangerous, seizing and tearing to pieces every animal they could lay hold of, and expressing extreme eagerness to get at those accidentally brought within sight of their cage, by grasping the iron bars with their paws and shaking them violently, to the great terror of spectators, who felt insecure while witnessing such displays of their strength. In one instance, an unfortunate monkey was walking over the top of their cage, when the end of the chain which hung from his waist, dropped through within reach of the bears; they immediately seized it, dragged the screaming animal through the narrow aperture, tore him limb from limb, and devoured his mangled carcass almost instantaneously. At another

time a small monkey thrust his arm through an opening in the bear cage, to reach after some object; one of them immediately seized him, and, with a sudden jerk, tore the whole arm and shoulder-blade from the body, and devoured it before any one could interfere. They were still cubs, and very little more than half grown, when their ferocity became so alarming, as to excite continual apprehension, lest they should escape, and they were killed in order to prevent such an event.

To the venerable founder of the Philadelphia Museum, Charles Willson Peale, to whom American students of natural history, are under the most lasting obligations for his zeal and liberality, we are indebted for the following letter, written by the gallant and lamented Pike, relative to the two grizzly bears above mentioned:

Washington, Feb. 3d, 1808.

Sir,—I had the honour of receiving your note last evening, and in reply to the inquiries of Mr. Peale, can only give the following notes.

The bears were taken by an Indian, in the mountains which divide the large western branches of the Rio Del Norte, and some small rivers which discharge their waters into the east side of the gulf of California, near the dividing line between the provinces of Biscay and Senora. We happened at the time to be marching along the foot of those mountains, and fell in with the Indian who had them, when I conceived the idea of bringing them to the United States, for your Excellency, although then more than 1600 miles from our frontier post, (Natchitoces,) purchased them of the savage, and for three or four days made my men carry them in their laps, on horseback. As they would eat nothing but milk, they were in danger of starving. I then had a cage prepared for both, which was carried on a mule, lashed between two packs, but always ordered them to be let out the moment we halted, and not shut up again, until we were prepared to march. By this treatment they became extremely docile when at liberty, following my men (whom they learned to distinguish from the Spanish Dragoons, by their always feeding them and encamping with them,) like dogs, through our camps, the small villages, and forts, where we halted. When well supplied with sustenance, they would play like young puppies with each other, and the soldiers; but the instant they were shut up and placed on the mule, they became cross, as the jostling of the animal knocked them against each other, and they were sometimes left exposed to the scorching heat of a vertical sun, for a day, without food or a drop of water, in which case they would worry and tear each other, until nature was exhausted, and they could neither fight nor howl any longer. They will be one year old, on the first of next month, (March 1808,) and as I am informed, they frequently arrive at the weight of eight hundred pounds.

Whilst in the mountains, we sometimes discovered them at a distance, but in no instance were we ever able to come up with one, which we eagerly sought, and *that* being the most inclement season of the year, induces me to believe, they seldom or never attack a man un-

provoked, but defend themselves courageously;* an instance of this kind occurred in New Mexico, whilst I sojourned in that province;—three of the natives, attacked a bear, with their lances, two of whom he killed, and wounded the third, before he fell the victim.

With sentiments of the
highest respect and esteem,
Your obedient servant,
Z. M. PIKE.

His Excellency, Thomas Jefferson,
President of the United States.

The grizzly bear, is remarkably tenacious of life, and on many occasions numerous rifle-balls have been fired into the body of an individual, without much apparent injury. Instances are related by the travellers who have explored the countries in the vicinity of the Rocky Mountains, of from ten to fourteen balls having been discharged into the body of one of these bears, before it expired. In confirmation of these statements we shall here introduce some sketches from narratives given in the journals of Lewis and Clark, and Long's Expedition to the Rocky Mountains.

One evening, the men in the hindmost of one of Lewis and Clark's canoes, perceived one of these bears lying in the open ground, about three hundred paces from the river, and six of them, who were all good hunters, went to attack him. Concealing themselves by a small eminence, they were able to approach within forty paces unperceived; four of the hunters now fired, and each lodged a ball in his body, two of which passed directly through the lungs. The bear sprang up and ran furiously with open mouth upon them; two of the hunters, who had reserved their fire, gave him two additional wounds, and one breaking his shoulder blade, somewhat retarded his motions. Before they could again load their guns, he came so close on them, that they were obliged to run towards the river, and before they had gained it, the bear had almost overtaken them. Two men jumped into the canoe; the other four separated, and concealing themselves among the willows, fired as fast as they could load their pieces. Several times the bear was struck, but each shot seemed only to direct his fury towards the hunter; at last he pursued them so closely that they threw aside their guns and pouches, and jumped from a perpendicular bank, twenty feet high, into the river. The bear sprang after them, and was very near the hindmost man, when one of the hunters on the shore, shot him through the head, and finally killed him. When they dragged him on shore, they found that eight balls had passed through his body, in different directions.

On another occasion the same enterprising travellers met with the largest bear of this species they had ever seen; when they fired he did

* It is very possible that the bears thus seen, may have been common black bears; the reader will find in the sequel abundant proofs that it is not difficult to come up with the grizzly bear, and that this animal does not often wait to be attacked.

not attempt to attack, but fled with a tremendous roar, and such was his tenacity of life, that although five balls had passed through the lungs, and five other wounds were inflicted, he swam more than half across the river, to a sand bar, and survived more than twenty minutes. This individual weighed five or six hundred pounds at least, and measured eight feet seven inches and a half from the nose to the extremity of the hind feet, five feet ten inches and a half around the breast, three feet eleven inches around the middle of the fore-leg, and his claws were four inches and three-eighths long.

In fact, the chance of killing the grizzly bear by a single shot, is very small, unless the ball penetrates the brain, or passes through the heart. This is very difficult to effect, since the form of the skull, and the strong muscles on the side of the head, protect the brain against every injury except a very truly aimed shot; and the thick coat of hair, the strong muscles and ribs, make it nearly as difficult to lodge a ball fairly in the heart.

Governor CLINTON, in the notes to his discourse delivered before the Literary and Philosophical Society of New York, says, "that Dixon, an Indian trader, told a friend of his, that this animal had been seen *fourteen feet long;* that notwithstanding its ferocity, it had been occasionally domesticated, and that an Indian belonging to a tribe on the head waters of the Mississippi, had one in a reclaimed state, which he sportively directed to go into a canoe belonging to another tribe of Indians, then returning from a visit: the bear obeyed, and was struck by an Indian. Being considered as one of the family, this was deemed an insult, resented accordingly, and produced a war between these nations."

Mr. JOHN DOUGHERTY, a very experienced and respectable hunter, who accompanied Major LONG's party during their expedition to the Rocky Mountains, several times very narrowly escaped from the grizzly bear. Once, while hunting with another person on one of the upper tributaries of the Missouri, he heard the report of his companion's rifle, and when he looked round, beheld him at a short distance endeavouring to escape from one of these bears, which he had wounded as it was coming towards him. Dougherty, forgetful of every thing but the preservation of his friend, hastened to call off the attention of the bear, and arrived in rifle-shot distance, just in time to effect his generous purpose. He discharged his ball at the animal, and was obliged in his turn to fly; his friend relieved from immediate danger, prepared for another attack, by charging his rifle, with which he again wounded the bear, and saved Mr. D. from further peril. Neither received any injury from this encounter, in which the bear was at length killed.

On one occasion several hunters were chased by a grizzly bear, who rapidly gained upon them. A boy of the party, who could not run so fast as his companions, perceiving the bear very near him, fell with his face toward the ground. The bear reared up on his hind-feet, stood for a moment, and then bounded over him in pursuit of the more distant fugitives.

Mr. DOUGHERTY, the hunter before mentioned, relates the following

instance of the great muscular strength of the grizzly bear. Having killed a bison, and left the carcass for the purpose of procuring assistance to skin and cut it up, he was very much surprised on his return to find that it had been dragged off, whole, to a considerable distance, by a grizzly bear, and was then placed in a pit, which the animal had dug with his claws for its reception.

This bear strikes a very violent blow with its fore-paws, and the claws inflict dreadful wounds. One of the cubs before mentioned as belonging to the Philadelphia Museum, struck the other a blow over part of its back and shoulder, which produced a large wound like a sabre cut. It is stated in Long's Expedition, that a hunter received a blow from the fore-paw of a grizzly bear, which destroyed his eye and crushed his cheek bone.

The grizzly bear is unable to climb trees like other bears; he is much more intimidated by the voice, than the aspect of man, and on some occasions, when advancing to attack an individual, he has turned and retired merely in consequence of the screams extorted by fear. The degree of ferocity exhibited by the grizzly bear, appears to be considerably influenced by the plenty or scarcity of food in the region it inhabits.

Anterior to the time of Lewis and Clark's expedition, nothing very satisfactory was known relative to this bear, and it was not until the publication of the journal of Long's Expedition to the Rocky Mountains, that a correct, scientific description, was given by that distinguished naturalist, Say.

It may be with certainty distinguished from all the known species of this genus, by its elongated claws, and the rectilinear or slightly arched figure of its facial profile. Its general appearance may be compared with the Alpine bear of Europe, (U. Arctos) especially with the Norwegian variety. The Alpine bear has not the elongated claws, and the facial space is deeply indented between the eyes.—This bear is also a climber; the grizzly bear is not.

On the front of the grizzly bear the hair is short, and between and anterior to the eyes, it is very much so. On the rest of the body it is long and very thickly set, being blacker and coarser on the legs, feet, shoulders, throat, behind the thighs, and beneath the belly; on the snout it is paler. The ears are short and rounded, the forehead somewhat convex or arcuated, and the line of the profile continues on the snout, without any indentation between the eyes.

The eyes are quite small, and have no remarkable supplemental lid. The iris is of a light reddish brown, or burnt Sienna colour. The muffle of the nostrils is black, and the sinus very distinct and profound. The lips are capable of being extended anteriorly, especially the upper one, which has on it a few more rigid hairs or bristles than the lower lip. The tail, which is very short, is concealed by the hair. The length of the hair gradually diminishes on the legs, but is still ample in quantity on the upper part of the foot.

The claws on the fore-feet are slender and elongated, and the fingers have five sub-oval naked tubercles, separated from the palm, each other, and the base of the claws, by dense hair. The anterior half of

the palm is naked, and is of an oval figure transversely,—the base of the palm has a rounded naked tubercle encircled by hair.

The soles of the (hind) feet are naked, and the nails are more curved and not so long as those on the fore-paws. The nails are not in the least diminished at tip, but they grow sharper at that part only by lessening from beneath.*

The colour of the grizzly bear varies very considerably, according to age and its particular state of pelage. Hence they have been described as brown, white, and variegated, by Lewis and Clark, although evidently of the same species, judging by all the other characters. The colour of the young animal approaches more nearly to the brown bear of Europe than any other; in advanced life the colour is that peculiar mixture of white, brown, and black, which has procured for this bear the appropriate designation of "Grizzly."

The following are the dimensions of the specimens preserved in the Philadelphia Museum, as given by SAY.

Length from the tip of the nose to the origin of the tail,	5 ft. 2 in.
The tail exclusive of the hair at tip,	$1\frac{3}{4}$
From the anterior base of the ear to the tip of the nose,	6
Orbit of the eye,	$\frac{3}{4}$
Between the eyes,	$4\frac{2}{3}$
Ears from their superior base,	3
Longest claw of the fore-foot,	$4\frac{1}{3}$
Shortest,	$2\frac{3}{4}$
Longest claw of the hind-foot,	3
Shortest,	$1\frac{3}{4}$
Hair at the tip of tail,	$4\frac{1}{2}$
Length of the hair on the top of the head,	$1\frac{3}{4}$ to 2
Beneath the ears,	$2\frac{1}{2}$ to $3\frac{1}{2}$
On the neck above,	3
On the shoulders above,	$4\frac{1}{2}$
On the throat,	4
On the belly and behind the fore-legs the longest hairs are	6

These measurements are taken from two individuals which were by no means full grown, as may be perceived by comparing them with the measurements heretofore cited from Lewis and Clark.—They will serve, however, to give a fairer idea of the proportions of this animal than any which have been previously given, as they are so much more detailed and very carefully made.

On softening cast Iron.

The subjoined extract from the reports of Mr. Strickland (just published) will probably bring to mind some statements made in our first number, on the subject of the art of rendering cast-iron malleable, as practised in England. The *Cumberland red ore*, is, it appears, found in various parts of the Island of Great Britain, and there are, undoubt-

* Ursi Horribilis testes saccis duobus distinctis, etiam ad quatuor pollicum segregatis, pendunt.

edly, several varieties of iron ore in the United States, which will answer the same purpose. The Cumberland ore is probably an *argillaceous oxide of iron*. The *Hematetic iron ore*, which consists of oxide of iron, silex, and alumine, has been successfully used in England, but as it is a very hard substance, the difficulty of reducing it to powder, in sufficient quantities, is a bar to its employment in the large way.

The *Ochery red oxide of iron*, (red-ochre) is known to abound in many of the states, and is, probably, similar to that of Cumberland. The *Bog-ore*, so abundant in New Jersey, and in many other places, would be likely to answer the purpose, when not contaminated by phosphate of iron. Those who are interested in experimenting upon the subject, would do well to make the essay with the several varieties of ore which they can obtain, as the comparative goodness of each might then be ascertained, in a single operation. [*Editor.*

"There has been a method lately discovered, to make cast metal, soft and malleable; and there are already many large manufactories put up, for this very important process. I have visited one of them in London, and witnessed the operation. The method consists, in placing the cast metal in a case or pot, along with, and surrounded by, a soft, red ore, found in Cumberland, and other parts of England. The cases are then put into a common oven, built with fire-bricks, and without a chimney, where they are heated with coal or coke, placed upon a fire-grate. The doors of the oven are closed, and but a slight draft of air permitted under the grate; and thus a regular heat is kept up, for the space of seven days, or two weeks, depending on the thickness and weight of the castings. The cases are then taken out, and suffered to cool, and the hardest cast metal is, by the operation, rendered so soft and malleable, that it may be welded together, or when in a cold state, bent into almost any shape, by a hammer or vice. In this manner are all articles, such as harness buckles, bridle bits, horse shoes, and even nails, made tough and malleable. Cast horse shoes, submitted to this process, have, after being worn out by the action of the horses' feet, been converted into penknives, and other articles of cutlery, of a superior quality. I have procured a specimen of the red ore used in this valuable process, together with a few articles of the hardest cast iron, which have been softened, and rendered perfectly malleable. Those castings, however, which are made from pig iron containing the smallest portion of carbon, are the best adapted for conversion into malleable iron: the only effect produced by the introduction of the red ore, along with the metal, is to deprive it of its carbon."

Letter from ROBERT HARE, M. D. *Professor of Chemistry, in the University of Pennsylvania, to Dr. Thomas P. Jones, Editor of the Franklin Journal; on the means of preventing, or extinguishing fires in Steam Boats.*

Dear Sir,

Since I wrote to you on the causes of the explosions of Steam-boat boilers, I have seen the account of the loss by fire, of the Steam-brig New York.

The escape of the passengers from drowning or burning, appears to have been due to their number being fortunately small, and the accidental proximity of the boat to the land. This is an appalling contingency; yet I feel confident, that it is possible to lessen, if not to put an end to all danger, from this source.

In the first place, the flues and the furnace may be so situated, that the wood work can in no case be set on fire by them. In the second place, by means of a capacious pump to be worked by the engine, and other pumps in different parts of the vessel, to be worked by the crew and passengers, a torrent of water might in a few moments, by the aid of hoses and pipes, be directed upon the fire.

It would be highly important to have also a number of leather fire buckets hung up in an appropriate place, and kept in order; also, buckets with ropes attached to them, to draw up water by hand. The crew should be trained to use the pumps, the hoses, and the buckets for drawing water. If a due degree of discipline were established among them, the efforts of the passengers would soon take the same direction; so that their numbers would tend to diminish the danger, instead of rendering it greater.

There should be at least four good hand pumps, two forward and two aft, besides the pump to be wrought by the engine. From this pump, which could always be used when the fire should not be so situated as to incapacitate the machinery, two iron pipes should proceed, one to the forward, the other to the after part of the boat; to these pipes there should be large cocks with hose permanently attached, of length sufficient to command the greater part of the boat. Each hose should always be kept upon a reel; so that on the captain's giving an order to work the fire pump, either might be immediately ready for use, and the water spouting, from the terminating pipe, be under the direction of one of the crew, who should be trained for that purpose, to know his post, and perform his duty with skill and agility.

I am, &c.

ROBERT HARE.

New Steam Engine.

NORFOLK, VIRGINIA, August 17, 1826.

It affords us much pleasure, to notice briefly, an ingenious invention by a townsman of ours, Mr. Matthew Cluff, which, dispensing with all complicated apparatus, and even that of ordinary pistons and valves,

at once applies this valuable agent to the purpose of impelling a wheel of any diameter with an equable motion, capable of being applied to any species of machinery. We yesterday saw the model (upon a small scale) in operation, and were struck alike with the simplicity of the machine, and the ease and regularity of its movement. A very correct idea of it may be formed by supposing one end of a plain tube, of any dimensions required, to be inserted into a boiler, round which a fire is made, and the other end entering near the bottom, a reservoir of water, heated by the steam continually passing into it through the tube. In the reservoir, a wheel with buckets, similar to that of an overshot mill, revolves on a common axis, deriving its motion, (which is rapid and of a power susceptible of any augmentation desired) from the steam, which in its ascent from the bottom of the reservoir where the tube enters, continually fills the buckets and gives the wheel the necessary impetus.

We understand that Mr. Cluff intends to apply for a patent for his invention, and will probably test its value, by erecting a machine without delay.

Remarks by the Editor.—If we understand the above description, we apprehend that the proposed *improvement* may serve to swell the list of patents, but not to facilitate the application of steam, as a motive power. The proposed wheel, is, it appears, to wade in water, which its ascending and descending buckets must displace; this will consume a considerable portion of power;—and what is the power which is to overcome this resistance, and to propel the machinery? We see none, excepting the difference in the density of the water, and of the steam contained in the ascending buckets; and this will, in practice, be much less than that which would be produced by blowing air through the tube, and filling the buckets with this, instead of with steam.

The correctness of this remark will appear, when it is recollected that if the water in the trough be kept at a boiling heat, steam will ascend from it, on both sides of the wheel; and, if not at a boiling heat, the steam discharged through the pipe, will be in great part condensed, and the fuel be consequently used in vain.

Were oil substituted for water, in filling the trough, some of these objections would be removed, and we think that the *model* would be improved, but that the improvement would still end there.

The greater number of proposed improvements in the steam engine, equally manifest the possession of ingenuity, and the deficiency of knowledge and experience, in their projectors. Much time and money would be saved, and much mortification prevented, would inventors more generally avail themselves of the facilities afforded by the *Franklin Institute*, of acquiring practical information upon all subjects connected with mechanics.

The committee of inventions, is appointed for the express purpose of examining all machines and improvements, for the sole benefit of inventors; the utmost secrecy being observed, when necessary, and the first talents being employed in the respective departments, in order that correct information may be given, and that, without expense to the applicant.

Self acting Piano Forte.

The Dublin Journal gives a long notice of the mechanism of an ingenious instrument of this kind, stating that it performs, with extraordinary effect, some of the most classical and difficult music, and that great difficulties have been surmounted by the inventors. It combines the utmost rapidity and brilliancy with distinctness and neatness, and they venture to affirm, that there are few players of the piano-forte that can equal it, in these qualities. Its harmony is necessarily more full than can be produced by eight fingers, the elements of chords having no other limit than the extent of its scale. The instrument not only plays the usual piano-forte part of a piece, but takes in also, the subject of some parts of the score; its *crescendo* and *diminuendo* are graduated with more precision than can be effected by means not mechanical, the time cannot be otherwise than perfectly equable throughout, yet where pathos is to be expressed, the time can be retarded or accelerated, in any degree. In short, this admirable instrument manifests all the capabilities of a living performer, and superadds qualities derivable only from mechanical agency.—The mechanism is simple; it consists of a cylinder which turns on its axis, and is acted on by a coiled spring, and regulated by a fly wheel. On the surface of the cylinder, a proper arrangement of brass pins is formed, each of which, in passing under a rank of levers, elevates one end of the required lever, and depresses the other. The pressed end, pulls down with it a slender rod, which is connected by a slide with the tail of a bent lever, on the further end of which is the hammer which strikes the string.—The slides can be shifted further from, or nearer to, the axis, on which the hammer lever turns, and thus the stroke of the hammer is made feeble, or strong, to any required degree. When wound up, the instrument will continue to play for a considerable time; and it is provided with a set of keys like the ordinary piano-forte, so that a person may accompany the instrument, or play a duet with it, the effect of which is said to be beautiful.

Remarks by the Editor.—That *barrel piano fortes*, may as well be made, as barrel organs, every mechanisian well knows, and that they will hold the same comparative rank, no musician need be informed. The organist, however, will never wish for a barrel organ, nor the piano forte player, employ an automaton instrument, unless they can be made to express all the taste, feeling and variety of which keyed instruments are capable, however mechanically correct they may be in their execution. In fact, such instruments, although they may serve to show the consummate skill of the workman, ought never to be admitted as improvements, so far as the science of music is concerned, and will never be highly valued, excepting by those who cannot play.

Sugar from Beets.

The July number of the London Journal of Science and the Arts, contains an interesting article, on the manufacture of Sugar, from Beet Root. We extract, from that article, the following information.

"Mr. Dubrunfaut, (a French writer) states, that there are actually in France at present no less than 100 manufacturers of beet-root sugar, which may, he states, furnish altogether from four to five million pounds of raw sugar, (2000 to 2500 tons) which is not a twentieth part of the consumption of France. The largest manufacturers generally produce 40 to 50 tons per annum, some few more; but the average quantity, from his statement, appears to be only 20 to 25 tons per annum. He says the manufacturers are increasing in number; but if these data be correct, we are led to wonder why the manufacture has not been extended much more considerably in France, for in that country the duty on imported raw sugar is about 15s. 5d. per cent., or rather more than 1½d. per pound, from which duty the makers of beet-root sugar are exempted; if they however, can produce their sugar at 3¼d. or 3½d. per lb., the manufacture must be a very profitable one, as the selling prices are actually 4½d. to 5d. per lb. duty paid, and the article cannot be produced in the West Indies, and sold duty paid in France, for less. Dubrunfaut acknowledges this, and states it as a fact, which ought to encourage the extension of the beet-root manufacture. As, however, it has now been carried on in France to a greater or less extent, for above ten years, it seems reasonable to conclude that it does not yield so great a profit as to encourage its great extension, in preference to other commodities, and, consequently, that it cannot be produced (according to the mode of producing it now adopted) so cheap as is represented by Dubrunfaut.

"In England the beet-sugar I believe, could be produced nearly as cheap as in France, weight for weight, and as the cost of fuel for the manufacture would be much less, (in France it amounts to about ⅛ part of the whole cost of the manufacture, including the price of the roots,) it might be supposed that it would be a profitable manufacture; the more so, as the sugar imported from the British West India colonies, pays a duty of very near 3d. per lb. But it is probable the root would be much more expensive in working, from its greater bulk, and less productive of sugar, from the juice not being so well matured by the sun, as it is in France. I believe the experiment has not been tried.

"In Germany and other countries of Europe, the duties on imported sugar, are so small, that it is probable this manufacture will not be attempted."

Vermont Gold.

A beautiful piece of native gold, weighing nearly ten ounces, was lately found in the town of Newfane, Vermont. It was picked up by a boy near a small brook, and was studded with crystals of quartz. We have been favoured by Mr. French of this city, with the perusal of a letter from a friend in that place, from which we extract the following particulars. "A mass of native gold, weighing nearly ten ounces, has been found in this village, upon the farm of Samuel Ingram. In its general appearance, it strikingly resembles the North

Carolina gold—specific gravity 16.5—considered worth 89 cents per pennyweight. It was found on the bank of a stream, which empties into the branch opposite this village." We have seen another letter, which says that the inhabitants of the village "are about turning out on a grand search for more of the precious metal, and every witch-hazle thereabouts, has been subsidized for a mineral rod!" We understand that a gentleman in that neighbourhood is preparing a full and scientific description of the gold, and the region in which it was found.

FOR THE FRANKLIN JOURNAL.

On the importance of Drawing, to Mechanics.

Feeling the importance of a public institution, where the teaching of drawing constitutes a prominent feature, it appears to be proper to make such remarks as may tend to advance the views of the Franklin Institute in establishing a school, from which its members, and the public are to derive so many advantages.

As drawing is at present taught in the school connected with this Institution, it may be distinctly divided into two branches: the first, which is architectural, comprises all the departments of mechanical drawing; and the second, embraces the study of drawing, as connected with the fine arts. It is proper to observe, that mechanical drawing is immediately connected with various occupations; and is necessary to Cabinet-makers, Carpenters, Stone-cutters, and mechanists of all descriptions; and they, by their being instructed in a course of geometrical drawing, may acquire a knowledge of designing, relative to their professions, upon sound principles.

That branch of drawing which is termed miscellaneous, includes the useful and ornamental; it is like the aforementioned study, connected with various pursuits: a knowledge of this art, is indispensable in many departments of manufacture, such as printers of cottons, all woolen manufactures, that are ornamented, ornamental paper makers, chair-painters, chasers in various metals, Stucco workers, and painters of ornaments of all descriptions: it is essentially necessary to the student who wishes to make Painting his profession.

As the advantages and utility of the school are acknowledged by the public, it will be well to state what is necessary from the pupils, to render this academy more eminently beneficial. It must be observed, that very few persons feel aware of the difficulty of learning to draw well, and the time it requires to effect this object. It is therefore seriously recommended, that students should consider the importance of following up the plan they adopt, not commencing at the school, and relinquishing it after the first or second quarter; for it is by this determination only, that they may expect to obtain by industrious application, so much information and practice on the subject, as will render the pursuit interesting and beneficial to themselves, do honour to the Institution that fosters them, and credit to their teachers.

B.

Drawing School of the Franklin Institute.

The Drawing School for the evening, will commence at the Hall of the Franklin Institute, on the 2nd of October, 1826, and will continue until the 2nd of April, 1827; thereby forming two quarters of evening tuition. From that time, the school will be held in the morning, and so on throughout the rest of the year.

List of Patents granted in England for New Inventions, since May 23, 1826.

To Daniel Dunn, for an improvement or improvements upon the Screw-press, used in pressing of Paper, Books, Tobacco, or Bale Goods; and in the expressing of Oil, Extracts, or Tinctures; and for various other purposes, in which great pressure is required. Dated May 23, 1826.—To be specified in six months.

To Thomas Hughes, for improvements in the method of restoring foul or smutty Wheat, and rendering the same fit for use. Dated May 23, 1826.—In six months.

To Thomas Molineaux, for an improvement in machinery for spinning and twisting Silk and Wool; and for roving, spinning, and twisting Flax, Hemp, Cotton, and other fibrous substances. Dated May 23, 1826.—In six months.

To Thomas Parrant Birt, for certain improvements on, or additions to Wheel Carriages. Dated May 23, 1826.—In two months.

To John Parker, for certain improvements on, or additions to Park or other Gates. Dated May 23, 1826.—In six months.

To Dominique Pierre Deurbroucq, who, in consequence of a communication made to him, by a person residing abroad, is in possession of an apparatus adapted to cool Wort or Must, previous to its being set to undergo the process of Fermentation; and also for the purpose of condensing the Steam arising from Stills, during the process of distillation. Dated May 23, 1826.—In six months.

To William Henry Gibbs and Abraham Dixon, for a new kind of Piece Goods, formed by a combination of threads, of two or more colours; the manner of combining and displaying such colours, in such piece goods, constituting the novelty thereof. Dated May 23, 1826.—In two months.

To Joseph Smith, for an improvement on the Stocking-Frame; and an improved method of making stockings, and other goods usually made on the Stocking-Frame. Dated May 23, 1826.—In six months.

To John Loach, for a self-acting Sash-Fastener, which fastening is also applicable to other purposes. Dated May 23, 1826.—In six months.

To Richard Slagg, for an improvement in the manufacture of Springs, chiefly applicable to Carriages. Dated May 23, 1826.—In six months.

To Louis Joseph Marie, Marquis de Cambis, who, in consequence of a communication made to him by a certain foreigner, residing

abroad, is in possession of certain improvements in the construction of Rotatory Steam-Engines, and the apparatus connected therewith. Dated May 23, 1826.—In six months.

To James Barlow Fernandez, for certain improvements in the construction of Blinds or Shades, for Windows, or other purposes. Dated May 26, 1826.—In six months.

To Robert Mickleham, for certain improvements in Engines moved by the pressure, elasticity, or expansion of Steam, Gas, or Air; by which a great saving in fuel will be effected. Dated June 6, 1826.—In two months.

To Henry Richard Fanshaw, for an improved Winding Machine. Dated June 13, 1826.—In six months.

To John Ham, for an improved process for promoting the action of the Acetic Acid on Metallic Bodies. Dated June 13, 1826.—In six months.

To Thomas John Knowlys, who, in consequence of a communication made to him by a certain foreigner, residing abroad, is in possession of a new manufacture of Ornamental Metal or Metals. Dated June 13, 1826.—In six months.

NOTICES.

The Franklin Journal contains many articles of great interest to the mechanic, the agriculturist, the artist, and others. The Editor has seen with pleasure, a republication of many of them, in the daily and weekly journals; and as he is sincerely desirous of diffusing useful information, he will cheerfully loan any of his Wood-cuts to those editors who wish for them; exacting only a careful return of them, and due credit to the journal. The Jackson Democrat, printed at Reading, has used our pages freely, and advertised the work liberally; for which we acknowledge ourselves truly obliged.

Two of the plates referred to in Major Long's paper, are reserved for the next number.

A few additional copies of this paper have been printed, and may be had at Mr. Dobson's, stitched up in the pamphlet form, with four copper plates, at 25 cents each.

Owing to the absence of the Editor, during the time of printing a considerable portion of the last number, some trifling mistakes were made; and in the paper on *Mechanical Jurisprudence*, there were two; one of which materially interferes with the sense, and renders necessary the following

ERRATA.

P. 90, 3d line from bottom, for *Literce Patentes*, read *Literæ Patentes*.

P. 91, line 7th, the paragraph should end with the word 'Whatsoever;' and the next paragraph should read thus. Whenever this allowance interferes with the general freedom of trade, or occupation, by restraining the right of buying, selling, or using, any thing; the power to grant it, has been considered an odious prerogative.